VOL. XX. No. 3. MARCH 1935

MECCANO MAGAZINE

LOADING LOCOMOTIVES FOR CHINA
(see page 134)

6D.

A new and fascinating building hobby for boys and girls

MECCANO DINKY BUILDER

The new Meccano Dinky Builder, the latest thrill from Meccanoland, is a fascinating constructional toy specially designed for younger boys and girls. The parts, tastefully enamelled in jade green and salmon pink, are fitted together in the most simple and ingenious manner without the use of any nuts and bolts, giving results that are attractive and of exceptional interest. Two Outfits are available: No. 1 for general construction including wheel toys, and No. 2 for making groups of miniature furniture. Your dealer will be pleased to show you these new Meccano Dinky Builder Outfits.

No. 1 DINKY BUILDER OUTFIT

This Outfit contains a good selection of parts with which a large number of models can be made. It includes two trees on die-cast stands that lend the correct atmosphere to models of farm buildings, churches, etc. A further attraction are the wheels, finished in blue with white tyres, for constructing miniature wheel toys. The beautifully coloured instruction leaflet included in the Outfit illustrates a total of 44 models that any boy or girl can build.

Price **5/-**

No. 2 DINKY BUILDER OUTFIT

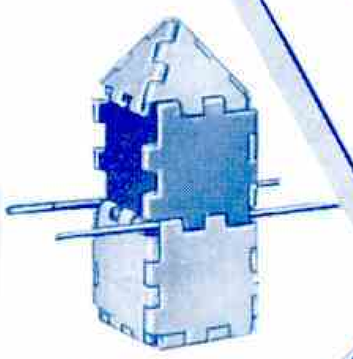
The No. 2 Dinky Builder Outfit contains a wide selection of parts primarily intended for the construction of realistic groups of miniature modern furniture. The small table lamp and shade that are included add greatly to the realism of these groups, particularly as the lamp can be lighted from an ordinary flash lamp battery. The coloured instruction leaflet gives examples of 7 furniture groups, but to an enthusiastic model builder the possibilities of the Outfit are practically inexhaustible.

Price **7/6**

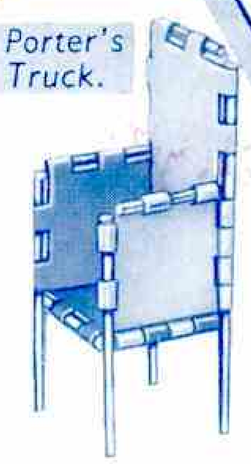
AN IDEAL CONSTRUCTIONAL TOY FOR BOYS AND GIRLS

No. 1 Dinky Builder Outfit.

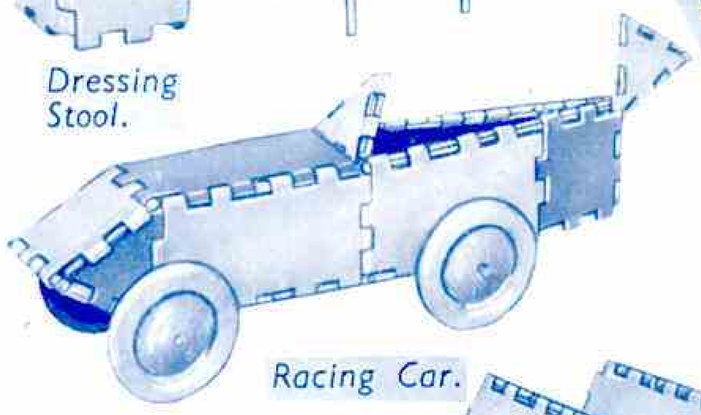
No. 2 Dinky Builder Outfit.

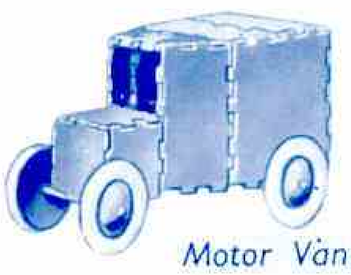

Sedan Chair.

Porter's Truck.

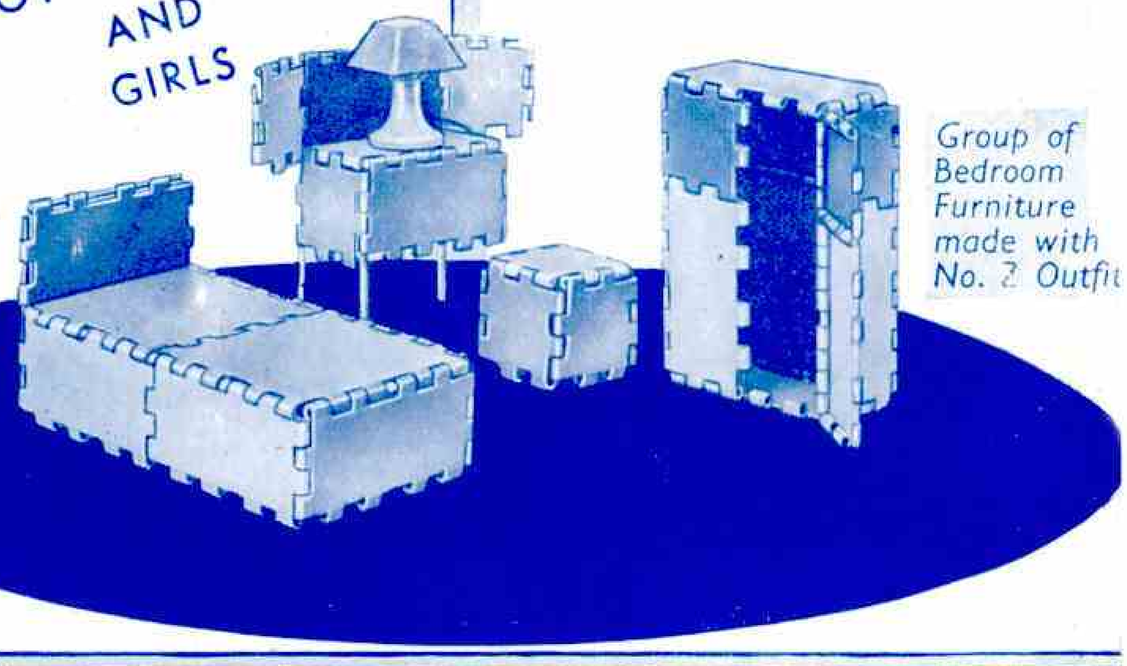

Arm Chair.

Dressing Stool.


Racing Car.


Motor Van.

Garage.


Group of Bedroom Furniture made with No. 2 Outfit

All the above models, and many others, can be made with No. 1 Dinky Builder Outfit.

Hamley's News

· HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

200-202, REGENT STREET, LONDON, W.1 **OUR ONLY ADDRESS**

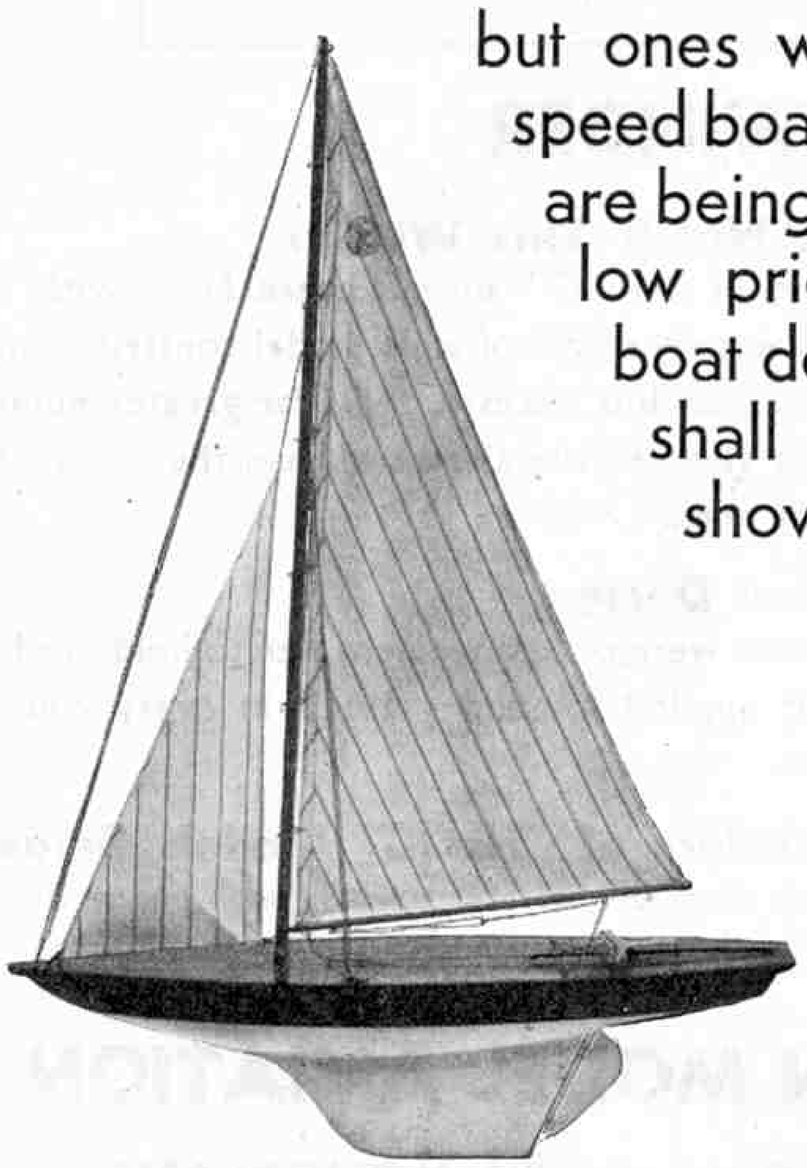
Number Twenty-three *March, 1935*

"A BOAT OF MY OWN"—MAGIC WORDS

but ones which nowadays can easily come true, for speed boats, yachts and cruisers are being made at amazingly low prices. Come to our boat department and we shall be delighted to show you our new designs.

SPEED BOAT. Hull 11 in. overall, fitted powerful clockwork motor. Adjustable rudder, windscreen, imitation deck. Price **2/6**

CLOCKWORK SPEED BOAT. Fitted powerful mechanism. Hull 16 in. overall. Fitted windscreen, dummy ventilators and bollards. Hull finished in blue and white with red line. Price **6/6**

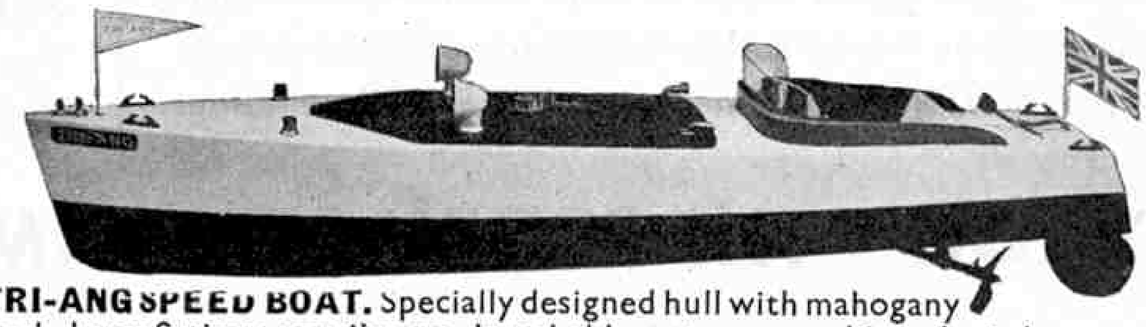


YACHT. Patent lightweight weather-resisting hull. Perfect balance. New solid lead cast keel. Polished mahogany deck. Chromium-plated automatic steering. Best quality striped sail cloth. Waterproof rigging cord, all brass fittings. Hull painted blue and white.

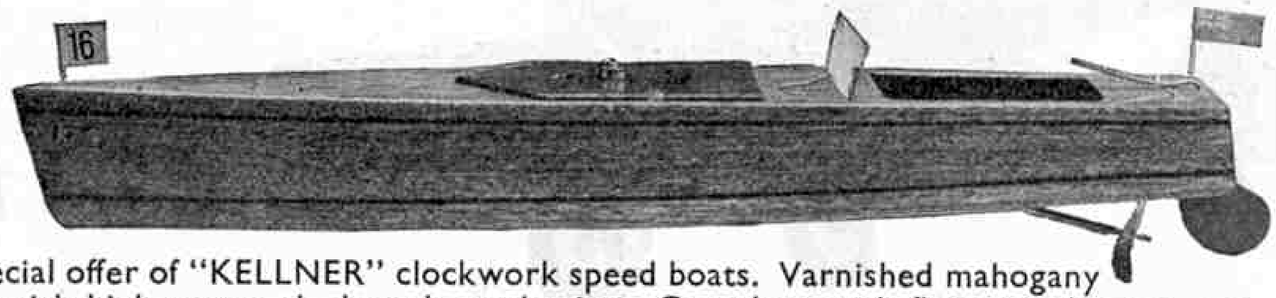
"Elizabeth." Length of hull 21 ins. Price **12/6**

"Margaret." Length of hull 26 ins. Price **19/6**

"Rosemary." Length of hull 32 ins. Price **29/6**

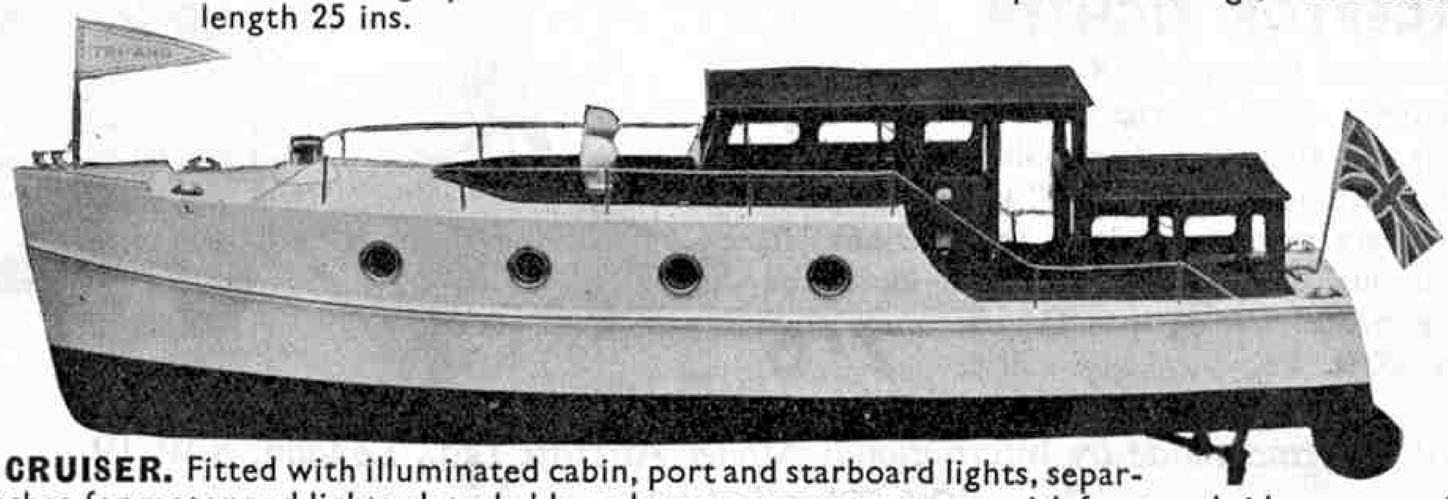


TRI-ANG SPEED BOAT. Specially designed hull with mahogany deck, brass fittings, ventilators, detachable motor cover, hinged windscreen, very powerful long-distance mechanism. Packed in special strong box, fitted with sponge rubber-covered safety blocks. "Tri-ang III," length of hull 20 ins. Price **19/6.** "Tri-ang IV," length of hull 23 ins. Price **25/–.** "Tri-ang V" (electric only), length of hull 28 ins. Price **35/–.** No. III and IV obtainable with electric mechanism at **21/—** and **29/6**



A special offer of "KELLNER" clockwork speed boats. Varnished mahogany hull, with high-power clockwork mechanism. Complete with flags, windscreen, etc. Overall length 25 ins. Price **10/6**

MODEL BOAT DEPARTMENT FIRST FLOOR



CABIN CRUISER. Fitted with illuminated cabin, port and starboard lights, separate switches for motor and lights, detachable mahogany superstructure, with front and side screens. "Dido," length of hull 20 ins., price **29/6.** "Juno," length of hull 23 ins., price **35/–.** "Venus," length of hull 28 ins., price **45/–.** Batteries **2/6** extra

SECRETS of SCALE MODEL AIRCRAFT DESIGN

5

The fifth of an interesting series of articles by the well-known designer responsible for the construction of the most perfect of all scale model aeroplanes, the "FROG" and "PUSS-MOTH"

THE UNIQUE "FROG" WINDER

A Unique Winder Feature

Here are a few interesting facts showing the advantages of the high-speed winder.

A geared-up winder is not in itself a novelty as it has been used for many years in order to facilitate quick winding of the better class of model aeroplanes. Where the "FROG" winder is concerned, however, its unique feature is in the fact that the machine is in all cases held in position in the box, thus making it possible for one person to wind the machine. If anybody has ever attempted to use the old "egg whisk" type which required both hands and a second person to hold the machine, they will realise the tremendous advantages of the simple method of "FROG" winding.

Gear Box Needs This Winder

The designers of "FROG" aircraft were faced with this problem in the early stages of scale model construction, as the use of the gear box necessitated a far greater number of turns being given to the airscrews than the non-geared type of aeroplane.

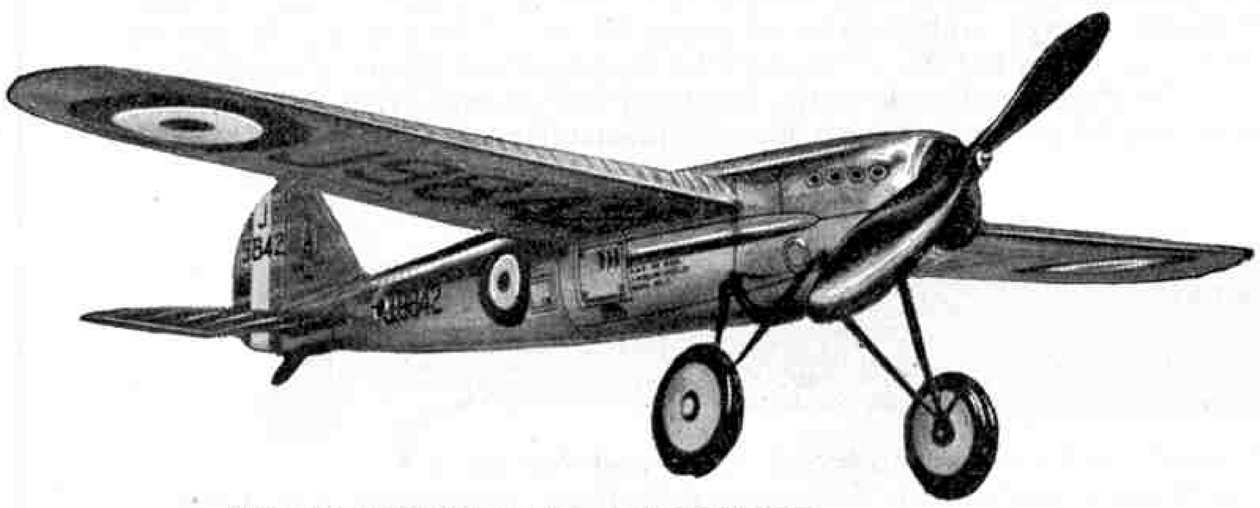
A Patented Design

As the machines were of a convenient size to hold in a box, a patent was applied for and granted in every country in the world.

Full Particulars of "FROG" Models Below

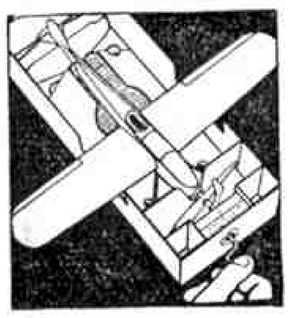
You will find illustrations and prices, with many details of the FROG models below.

"FROG"—THE FOREMOST NAME IN MODEL AVIATION



INTERCEPTOR FIGHTER

A scale model of high-speed Monoplane. Tubular construction, patented quick detachable fittings. High efficiency airscrew. A popular machine for realistic stunting. The "Frog" is sold complete with spare motors, lubricant and gear-box oil, patent high-speed winder box and illustrated flying manual. Wing span 11½ ins. Flies 300 ft. Price **7′6**

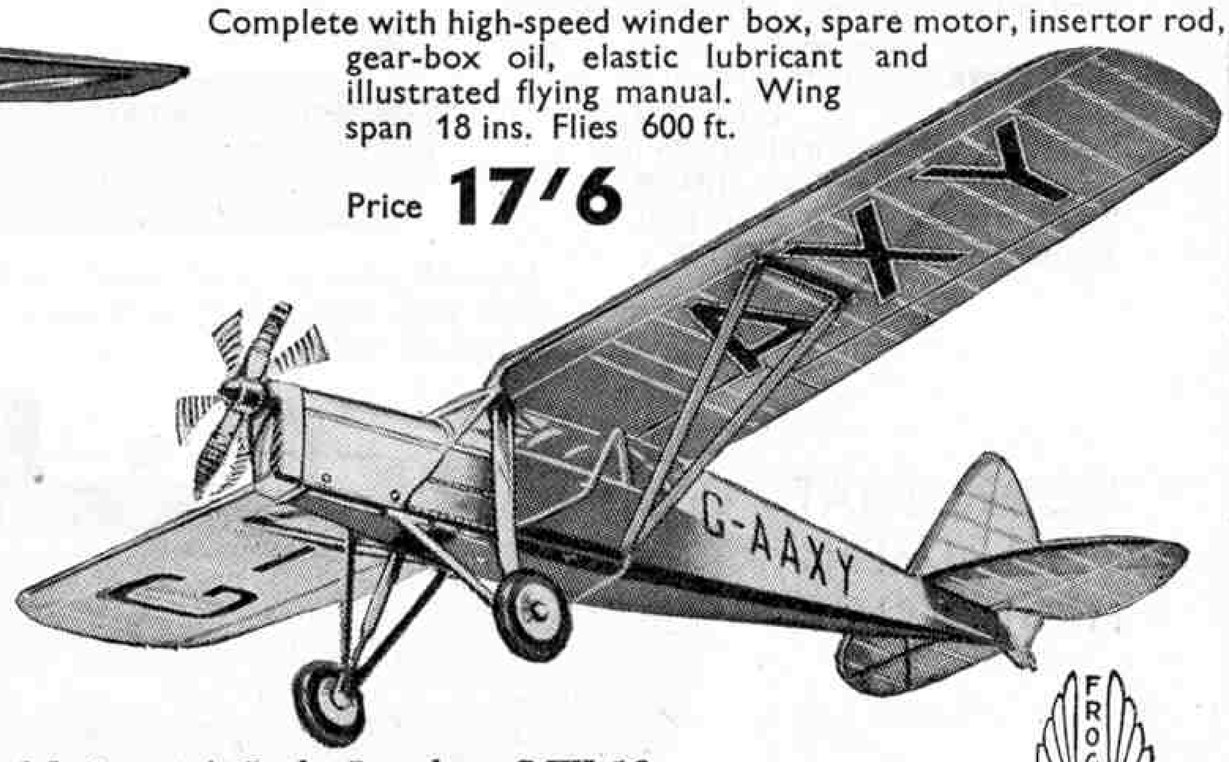


PUSS-MOTH MONOPLANE

A magnificent scale model of the famous record-breaking light aeroplane. All metal fuselage with bulk-head reinforcement, hollow wings of special design and construction. Dual motor-coupled gear box, transparent cabin and roof lights. "Frog" patent quick detachable fittings.

Complete with high-speed winder box, spare motor, insertor rod, gear-box oil, elastic lubricant and illustrated flying manual. Wing span 18 ins. Flies 600 ft.

Price **17′6**



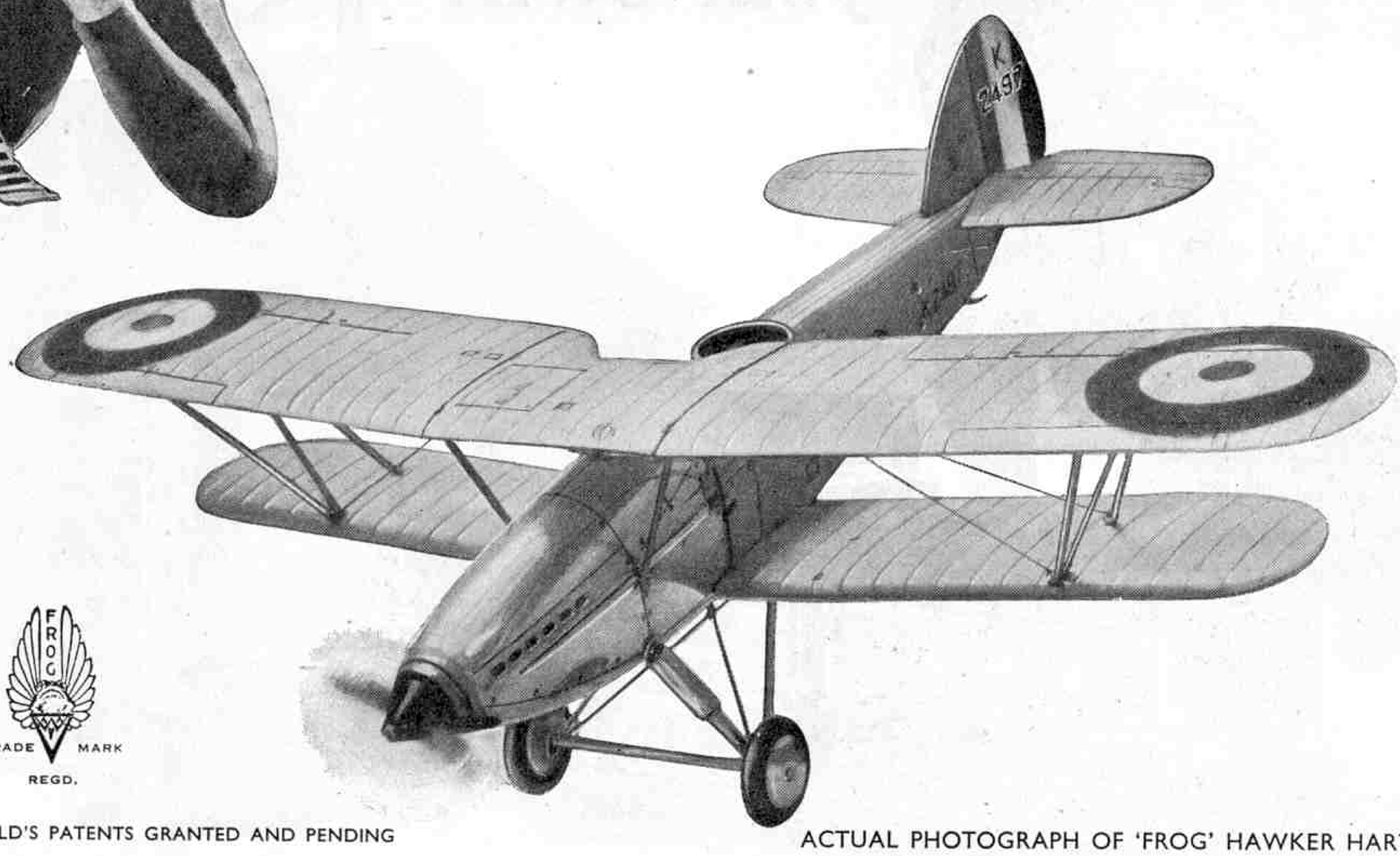
Designed and made by International Model Aircraft Ltd., London, S.W.19

SOLE CONCESSIONAIRES:

LINES BROS. LTD., *Tri-ang Works, Morden Rd., London, S.W.19*

FROG TRADE MARK REGD.

Seen the new HAWKER HART? 9ts made by the FROG people!



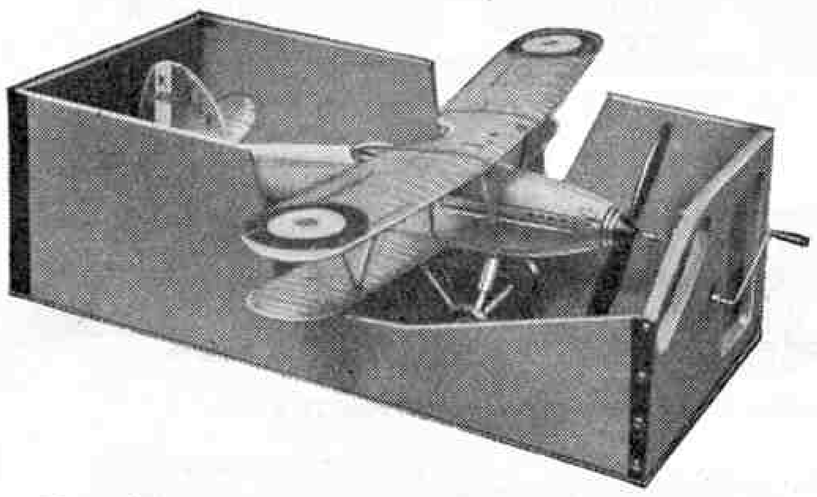
TRADE MARK REGD.

WORLD'S PATENTS GRANTED AND PENDING

ACTUAL PHOTOGRAPH OF 'FROG' HAWKER HART

The most famous military aeroplane in the world—the most formidable aerial weapon ever known—there's little need to tell you the name of the Hawker Hart. And now you may own and fly an almost exact reproduction in miniature of this wonderful fighter! The very latest 'Frog'—the flying scale model Hawker Hart—is waiting for you at your local shop to-day!

This 'Frog' Hawker Hart is designed (like the real machine) for short distance bombing. Every detail has been carefully considered to give complete realism to this wonder 'plane. There is actually a miniature Vickers-Scarff gun mounting ring before the observer's cockpit and a life-like instrument board in the pilot's cockpit. And the flying performance of this new machine is remarkable. Come and see the Hawker Hart now!



Complete with extra strong HIGH-SPEED WINDER-BOX, lubricant for Gearbox and motors, triple insertor rod, spare motors and profusely illustrated flying manual. **42/-**

SPECIFICATION

Telescopic spring-loaded under carriage. Unique fuselage built up on a reinforced structure of steel, duralumin and timber, covered either with aluminium, alloy sheet or a cellulose-paper—the only material capable of reproducing the exact form, shape and appearance of full-size aeroplane parts. Wings reinforced with internal ribbing and attached to fuselage with quick detachable fittings. Triple, 4-strand motor and watch type gearbox. Precision cut airscrew and spinner.

Wing Span, 18.75 ins. Overall Length, 15.36 ins.

Average Length of Flight, 700 ft.

Owners of a 'FROG,' PUSS MOTH or HAWKER HART are eligible for the handsome badges, price 6d. each, when the proficiency tests have been passed.

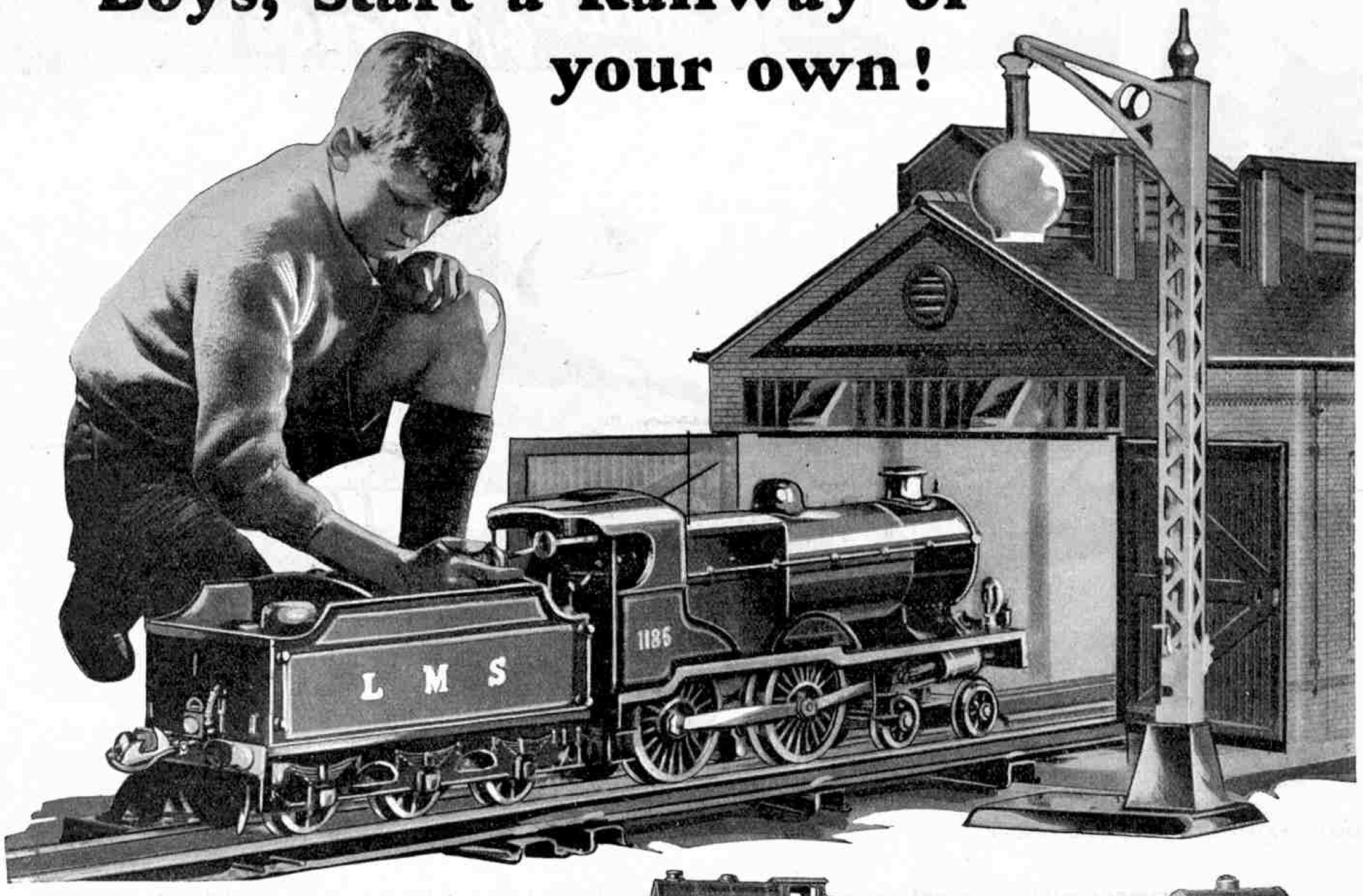
ON SALE AT ALL GOOD TOY SHOPS AND STORES

Made by INTERNATIONAL MODEL AIRCRAFT LTD., LONDON, S.W.19

Sole Concessionaires: LINES BROS. LTD., *Tri-ang Works, Morden Road, Merton, S.W.19*

Rather! And I've already won my FROG Pilot Badge with it

Boys, Start a Railway of your own!



You have spent many happy hours watching real trains at work. Now start a railway of your own and enjoy the thrill of operating Engines, Coaches, Wagons, Signals and Points on actual railway principles. It's the most fascinating pastime in the world!

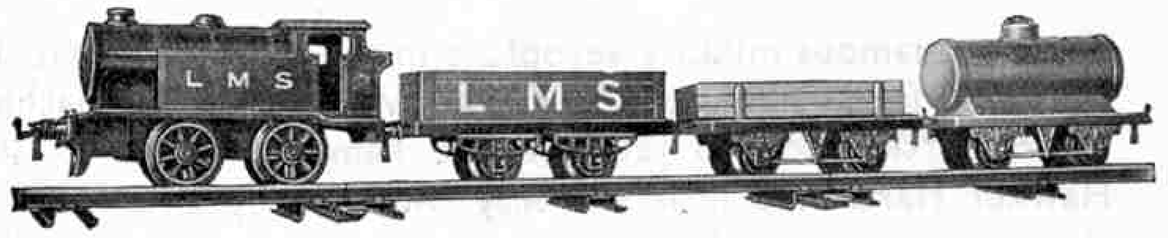
From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in practically every detail. There are Locomotives for all duties, driven by electric motors or by clockwork. There is Rolling Stock of all kinds including Pullman Cars, ordinary Coaches and Guard's Vans for passenger services, and numerous Wagons and Vans for freight working.

The Accessories are now better than ever before, while the Rails, Points and Crossings enable an endless variety of layouts to be constructed, both for Electric and Clockwork Trains.

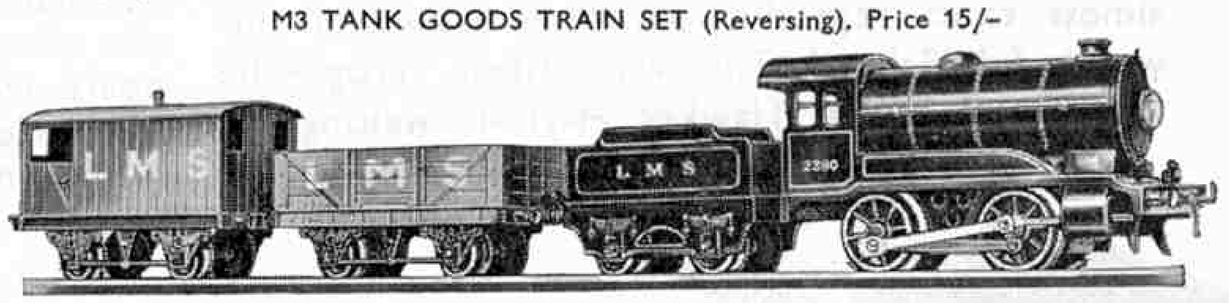
If you do not possess a Hornby Railway, now is the time to start. Ask your dealer for a copy of the latest Hornby Train Price List.

Prices of Hornby Electric Trains Sets from 15/– to 75/–

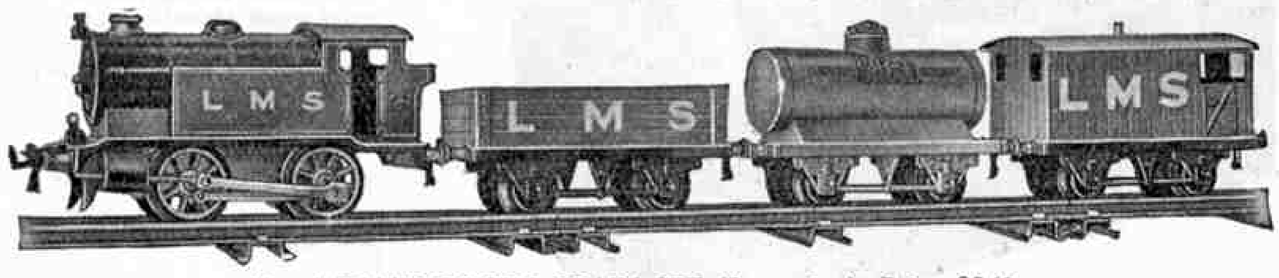
Prices of Hornby Clockwork Trains Sets from 4/11 to 65/–



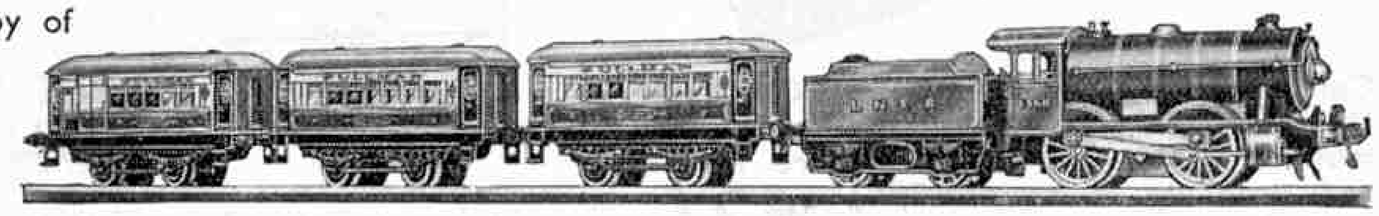
M3 TANK GOODS TRAIN SET (Reversing). Price 15/–



HORNBY No. E120 GOODS TRAIN SET (20-volt) Reversing. Price 36/–



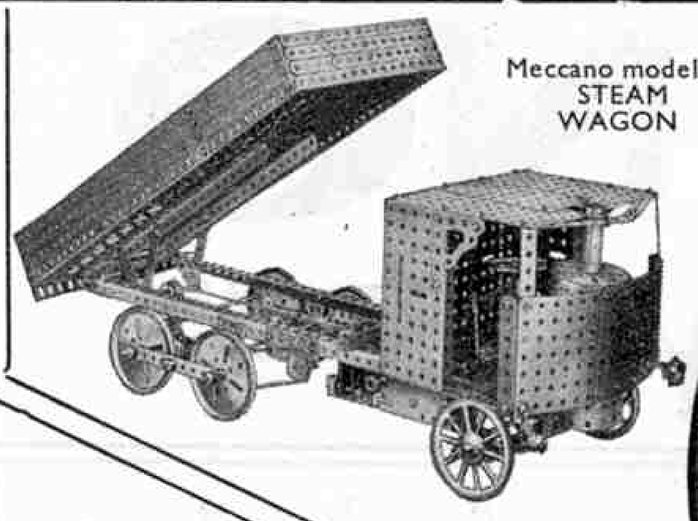
No. 1 TANK GOODS TRAIN SET (Reversing). Price 22/6



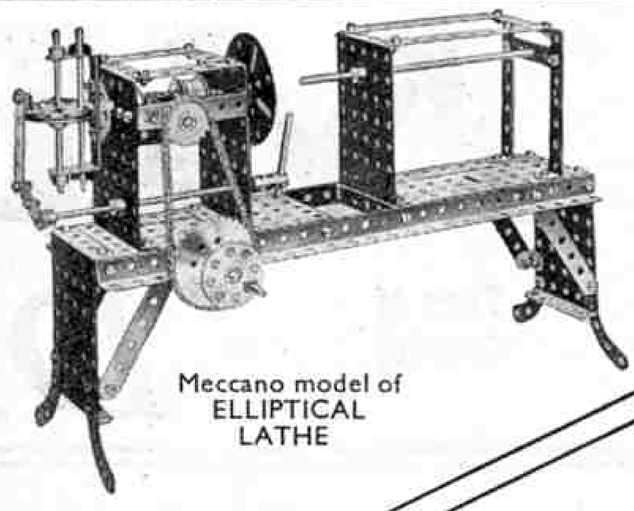
HORNBY No. E120 SPECIAL PASSENGER TRAIN SET (20-volt) Automatic Reversing. Price 48/6

HORNBY TRAINS

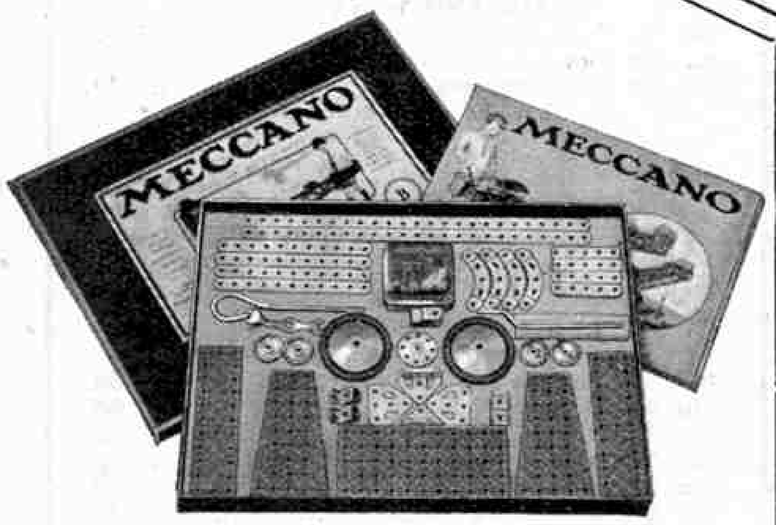
MANUFACTURED BY MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13



Meccano model of STEAM WAGON



Meccano model of ELLIPTICAL LATHE



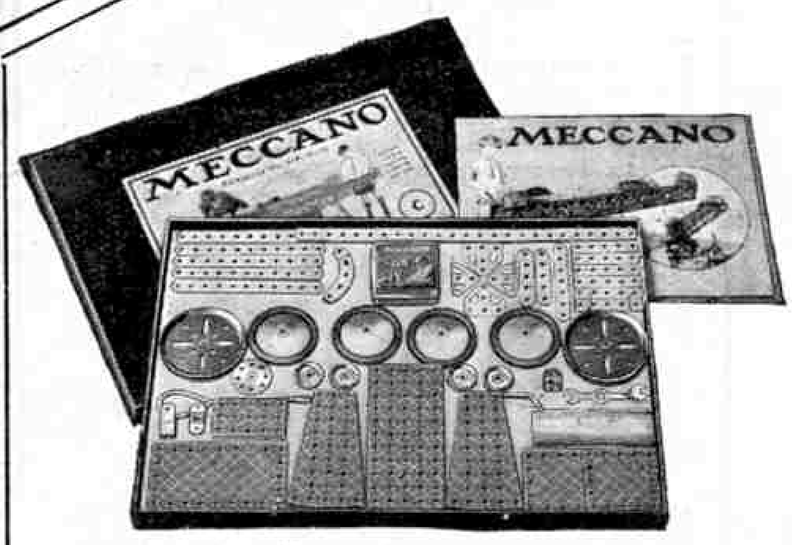
B Outfit. Price 7/6

THE WORLD'S BEST HOBBY FOR BOYS

When you are a Meccano boy you can build anything you want—with your Meccano Outfit. To-day a Travelling Crane; to-morrow a Motor Car Chassis; the next day a Traction Engine, a Lathe or a Loom. Day in and day out there is always something different to build—hundreds of models in the Manuals of Instructions to choose from, and hundreds of others that you can create and build yourself.

The Meccano System is better now than ever. All the parts are finished in a striking new colour combination of Blue and Gold, and the models constructed with them are of a brilliance never before attainable. In addition, the scope of the Outfits is greatly increased by the inclusion of new and specially designed parts.

See the New Meccano at your dealers. Take Dad with you!



C Outfit. Price 10/–

E Outfit. Price 20/–

PRICES OF MECCANO OUTFITS

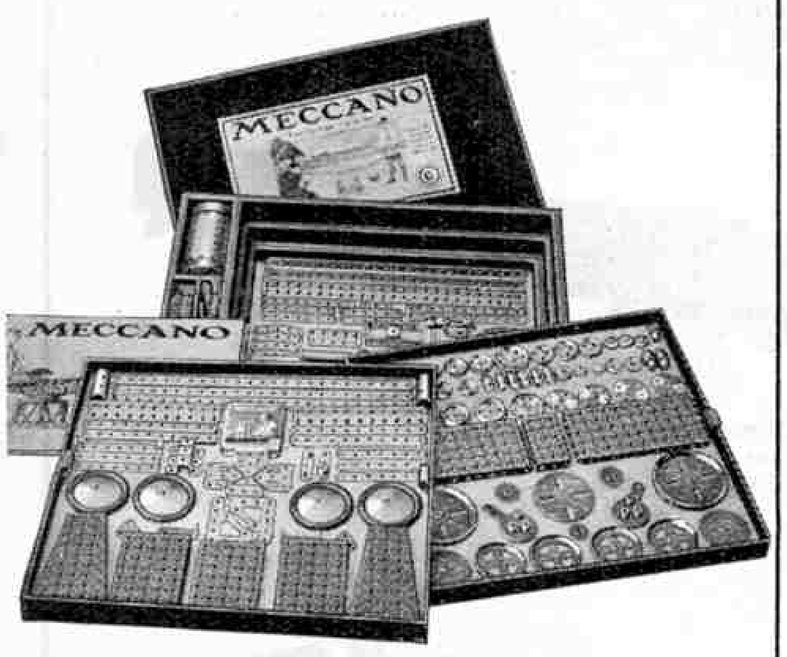
A	Outfit	... ... each	5/–
B	,,	... ... ,,	7/6
C	,,	... ... ,,	10/–
D	,,	... ... ,,	15/–
E	,,	... ... ,,	20/–
F	,,	... ... ,,	30/–
G	,,	... ... ,,	55/–
H	,,	(Carton) ... ... ,,	72/6
Hw	,,	(Cabinet) ... ... ,,	97/6
K	,,	(Carton) ... ... ,,	132/6
Kw	,,	(Cabinet) ... ... ,,	157/6
L	,,	(,,) ... ... ,,	410/–

PRICES OF MECCANO ACCESSORY OUTFITS – 2/6 to 225/–

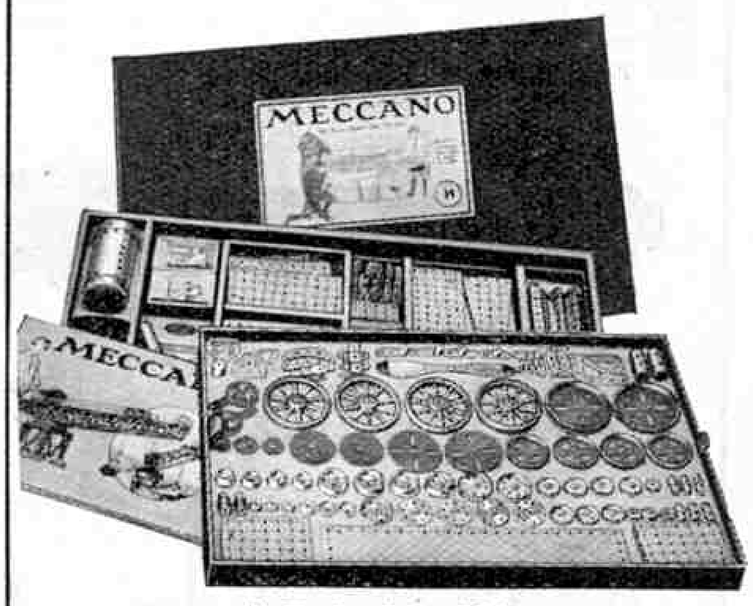
MAKE FRIENDS WITH YOUR DEALER—HE CAN HELP YOU

MECCANO LTD.
Binns Road, LIVERPOOL 13

F Outfit. Price 30/–



G Outfit. Price 55/–



H Outfit. Price 72/6

MECCANO

MECCANO

Toys of Quality

DINKY TOYS

The Best that you can buy

150 Varieties

The Meccano Dinky Toys form the most attractive and fascinating set of miniatures in existence. They are all well designed and beautifully finished in colour, and they include a remarkable amount of realistic detail.

Two of the most important recent additions are fine models of a Holland Coachcraft Van (Dinky Toy No. 31) and a Chrysler "Airflow" Saloon Motor Car (Dinky Toy No. 32). Both of these models are illustrated on the opposite page.

The Meccano Dinky Toys provide all the materials necessary for a fascinating collecting hobby. The range of subjects is very varied and there is ample scope for an extensive collection of outstanding interest. New items are continually being added to the series and collectors should keep a sharp look out for announcements.

With a few exceptions all the Dinky Toys are arranged in sets, but every item can be purchased separately.

Your Meccano dealer will be glad to show you the complete range of Meccano Dinky Toys.

Meccano Dinky Toys No. 1

STATION STAFF

No. 1a	Station Master	each 3d.
No. 1b	Guard	,, 3d.
No. 1c	Ticket Collector	,, 3d.
No. 1d	Driver	,, 3d.
No. 1e	Porter with bags	,, 3d.
No. 1f	Porter	,, 3d.

Price of complete set 1/6

Meccano Dinky Toys No. 4

ENGINEERING STAFF

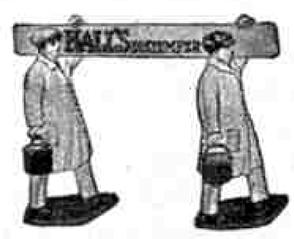
No. 4a	Electrician	each 3d.
No. 4b	Fitters (2)	,, 3d.
No. 4c	Storekeeper	,, 3d.
No. 4d	Greaser	,, 3d.
No. 4e	Engine Room Attendant ...	,, 3d.

Price of complete set 1/6

STATION OR FIELD HOARDING

This is a realistic accessory, suitable for model station platforms, or for fields adjacent to the railway track.

Price 6d.



Meccano Dinky Toys No. 13

HALL'S DISTEMPER ADVERTISEMENT

This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining a model railway track. Price 9d.

Meccano Dinky Toys No. 6

SHEPHERD SET

No. 6a	Shepherd ...	each 3d.
No. 6b	Dog	,, 2d.
No. 2d	Sheep ... (4) ...	,, 2d.

Price of complete set 1/–

Meccano Dinky Toys No. 5

TRAIN AND HOTEL STAFF

No. 5a	Pullman Car Conductor ...	each 3d.
No. 5b	Pullman Car Waiters (2) ...	,, 3d.
No. 5c	Hotel Porters (2)	,, 3d.

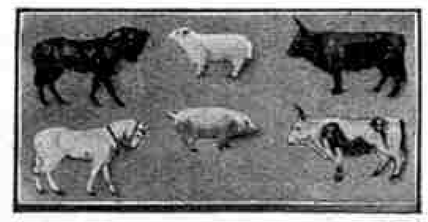
Price of complete set 1/3

Meccano Dinky Toys No. 3

PASSENGERS

No. 3a	Woman and Child	each 3d.
No. 3b	Business Man	,, 3d.
No. 3c	Male Hiker	,, 3d.
No. 3d	Female Hiker	,, 3d.
No. 3e	Newsboy	,, 3d.
No. 3f	Woman	,, 3d.

Price of complete set 1/6



Meccano Dinky Toys No. 2

FARMYARD ANIMALS

No. 2a	Horses (2) ...	each 3½d.
No. 2b	Cows (2) ...	,, 3½d.
No. 2c	Pig	,, 2d.
No. 2d	Sheep	,, 2d.

Price of complete set 1/6

New items are constantly being added to the series of Meccano Dinky Toys, to increase the fun and fascination.

Meccano Dinky Toys No. 17

PASSENGER TRAIN SET

No. 17a	Locomotive	each 9d.
No 17b	Tender	,, 5d.
No. 20a	Coach	,, 7d.
No. 20b	Guard's Van	,, 7d.

Price of complete set 2/3

Meccano Dinky Toys No. 18

GOODS TRAIN SET

No. 21a	Tank Locomotive	each 9d.
No. 21b	Wagons (3)	,, 4d.

Price of complete set 1/9

RAILWAY ACCESSORIES No. 7

Watchman's Hut, Brazier, Shovel and Poker. Price 1/3

Meccano Dinky Toys No. 19

MIXED GOODS TRAIN SET

No. 21a	Tank Locomotive	each 9d.
No. 21b	Wagon	,, 4d.
No. 21d	Petrol Tank Wagon	,, 6d.
No. 21e	Lumber Wagon	,, 5d.

Price of complete set 1/11

Meccano Dinky Toys No. 20

PASSENGER TRAIN SET

No. 21a	Tank Locomotive	each 9d.
No. 20a	Coaches (2)	,, 7d.
No. 20b	Guard's Van	,, 7d.

Price of complete set 2/6

RAILWAY ACCESSORIES No. 2

Milk Cans and Truck.

Price per set 1/3

RAILWAY ACCESSORIES No. 3

Platform Machines, etc. Price 1/6

RAILWAY ACCESSORIES No. 4

This set comprises all the pieces that are contained in Railway Accessories Nos. 1, 2 and 3. Price 3/9

RAILWAY ACCESSORIES No. 1

Miniature Luggage and Truck. Price 1/–

Manufactured by MECCANO LTD., Binns Road, LIVERPOOL 13

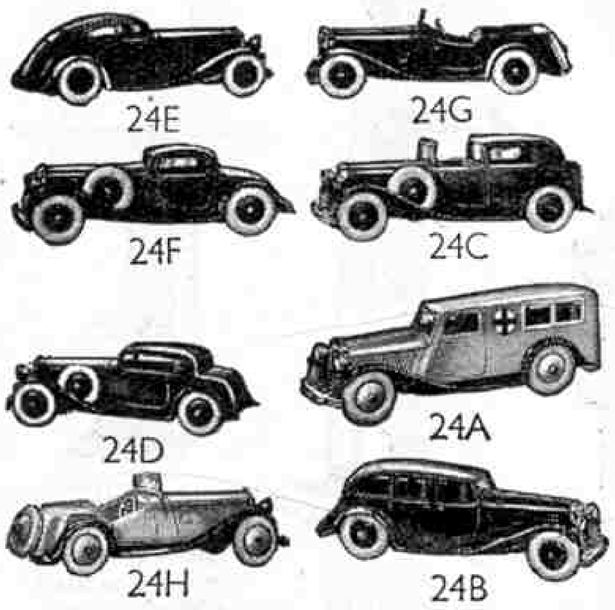
MECCANO

DINKY TOYS

Made of the finest materials

A fascinating collecting hobby

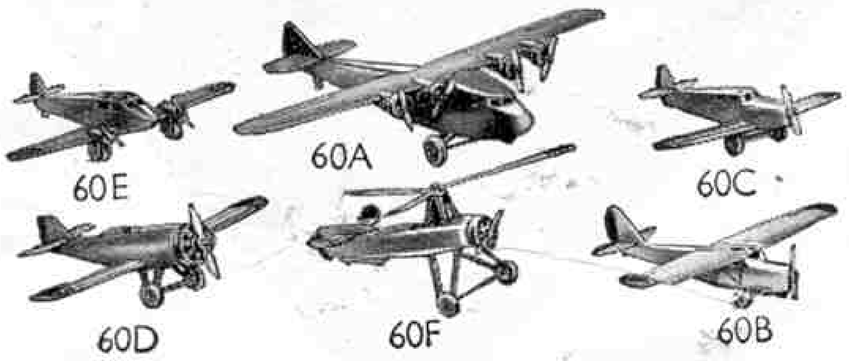
150 Varieties



Meccano Dinky Toys No. 24
MOTOR CARS
Fitted with rubber tyres and silver-plated radiators.

No. 24a	Ambulance	each 9d.
No. 24b	Limousine...	„ 9d.
No. 24c	Town Sedan	„ 1/–
No. 24d	Vogue Saloon	„ 9d.
No. 24e	Super Streamline Saloon	„ 9d.
No. 24f	Sportsman's Coupé ...	„ 9d.
No. 24g	Sports Tourer (4 seater)	„ 1/–
No. 24h	Sports Tourer (2 seater)	„ 1/–

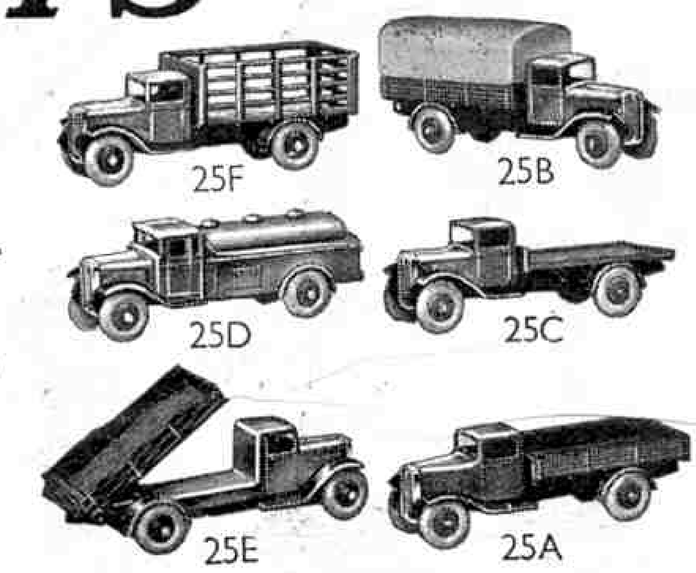
Price of complete set 6/6



Meccano Dinky Toys No. 60
AEROPLANES

No. 60a	Imperial Airways Liner ...	each 9d.
No. 60b	D.H. "Leopard Moth" ...	„ 6d.
No. 60c	Percival "Gull"	„ 6d.
No. 60d	Low Wing Monoplane ...	„ 6d.
No. 60e	General "Monospar" ...	„ 6d.
No. 60f	Cierva "Autogiro" ...	„ 6d.

Price of complete set 3/–

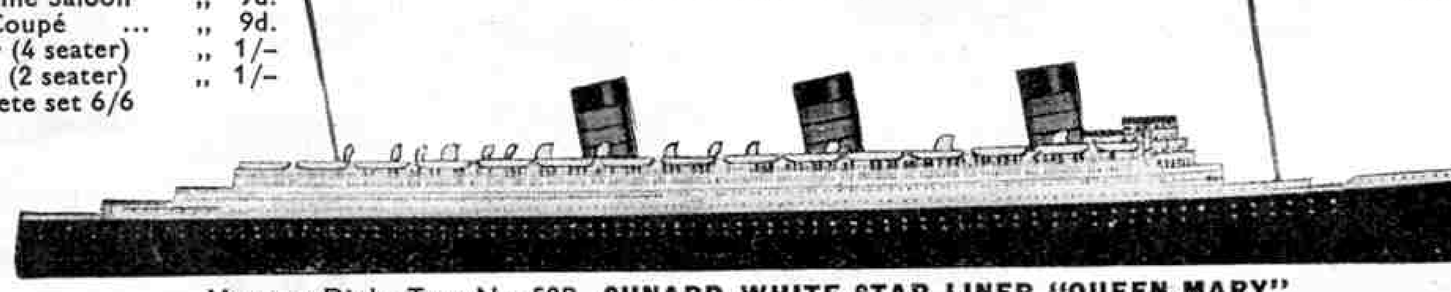


Meccano Dinky Toys No. 25
COMMERCIAL MOTOR VEHICLES
Fitted with rubber tyres and silver-plated radiators.

No. 25a	Wagon	each 9d.
No. 25b	Covered Van	„ 9d.
No. 25c	Flat Truck...	„ 9d.
No. 25d	Petrol Tank Wagon ...	„ 9d.
No. 25e	Tipping Wagon	„ 9d.
No. 25f	Market Gardener's Van...	„ 9d.

Price of complete set 4/6

Finished in Bright Colours

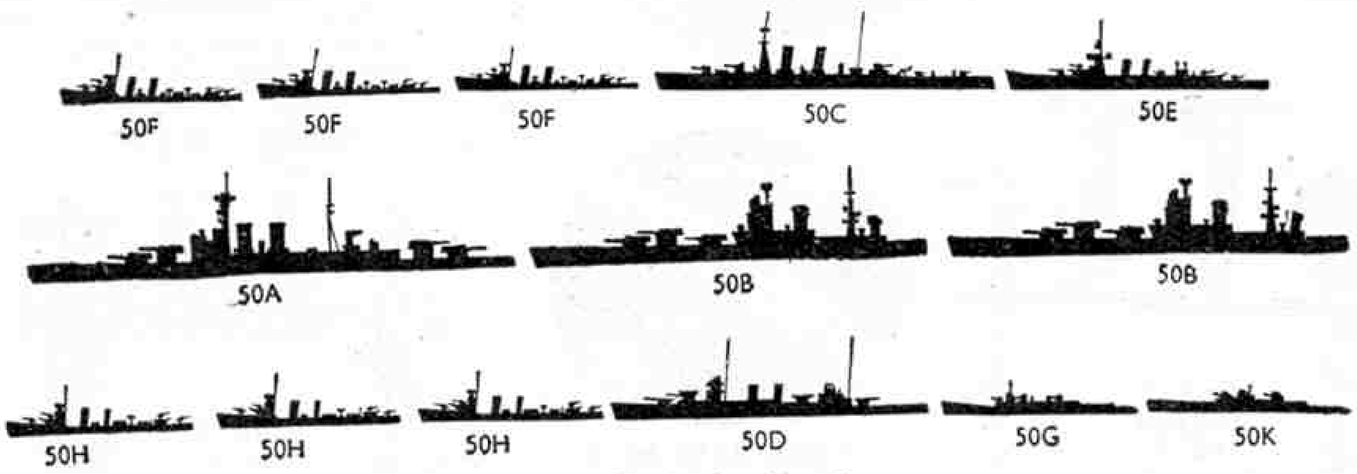


Meccano Dinky Toys No. 52B **CUNARD WHITE STAR LINER "QUEEN MARY"**
A scale model of the World's largest ocean liner. Price 1/– each

Meccano Dinky Toys No. 52a. Exactly as No. 52, but fitted with roller wheels. Price 1/– each

Realistic and Attractive Models

Meccano Dinky Toys No. 32
"AIRFLOW" SALOON
Assorted colours. Fitted with rubber tyres. Silver-plated radiator and bumpers.
Price 9d. each.

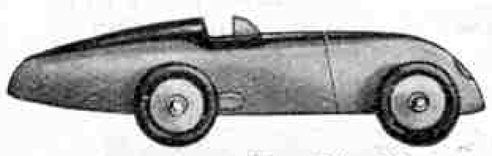


Meccano Dinky Toys No. 50
SHIPS OF THE BRITISH NAVY

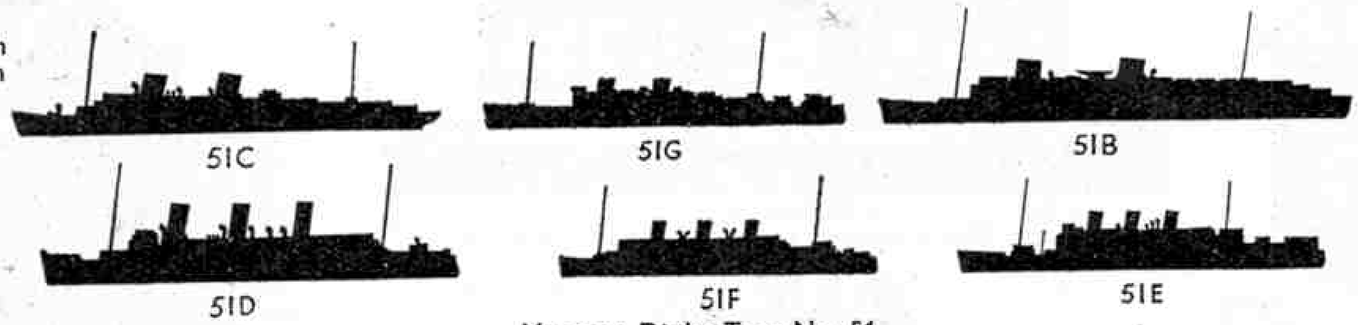
No. 50a	Battle Cruiser "Hood" ... each 9d.	No. 50e	Cruiser "Delhi" ... ... each 4d.
No. 50b	Battleships, "Nelson" Class (2) „ 6d.	No. 50f	Destroyers, "Broke" Class (3) „ 1d.
No. 50c	Cruiser "Effingham" ... „ 4d.	No. 50g	Submarine, "K" Class ... „ 1d.
No. 50d	Cruiser "York" ... ... „ 4d.	No. 50h	Destroyers, "Amazon" Class (3) „ 1d.
		No. 50k	Submarine, "X" Class ... each 1d.

Price of complete set 3/6

Meccano Dinky Toys No. 31
HOLLAND COACHCRAFT VAN
Assorted Colours
Price 6d. each.



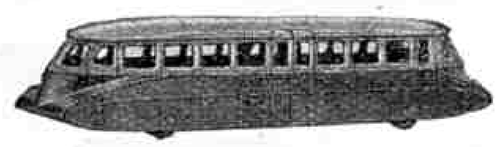
Meccano Dinky Toys No. 23
RACING CAR
Assorted Colours. Fitted with rubber tyres. Price 6d. each



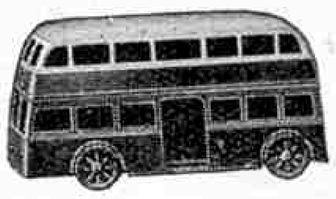
Meccano Dinky Toys No. 51
FAMOUS LINERS

No. 51b	"Europa"	... each 9d.	No. 51e "Strathaird" ... ... each 6d.
No. 51c	"Rex"	... „ 9d.	No. 51f "Queen of Bermuda" ... „ 6d.
No. 51d	"Empress of Britain"	... „ 8d.	No. 51g "Britannic" ... ... „ 6d.

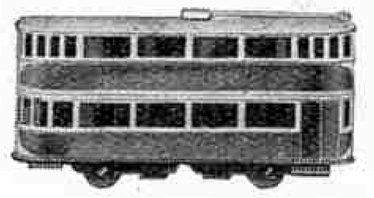
Price of complete set 3/6



Meccano Dinky Toys No. 26
G.W.R. RAIL CAR
Assorted Colours. Price 6d. each



Meccano Dinky Toys No. 29
MOTOR BUS
Assorted Colours. Price 6d. each



Meccano Dinky Toys No. 27
TRAM CAR
Assorted Colours. Price 6d. each

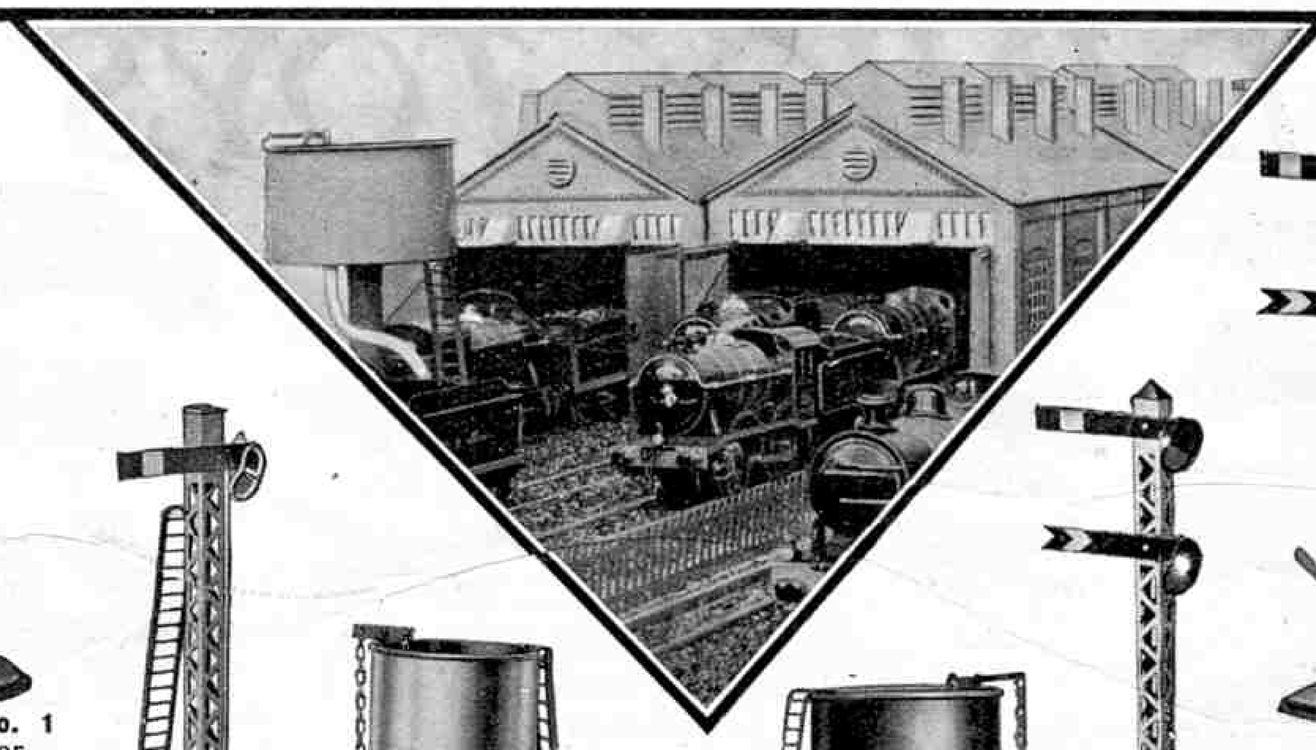
Manufactured by MECCANO LTD., Binns Road, LIVERPOOL 13

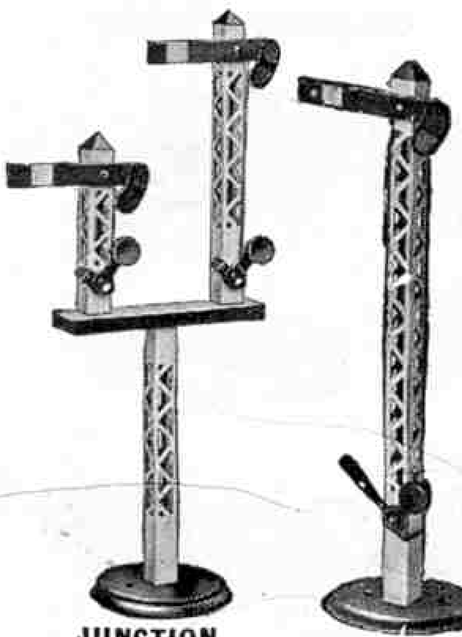
Hornby Series

HORNBY ACCESSORIES

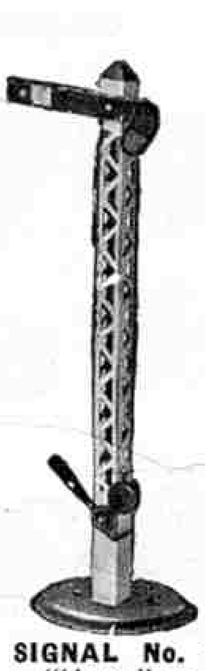
Gauge O

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown on this page. Ask your dealer to show the full range.

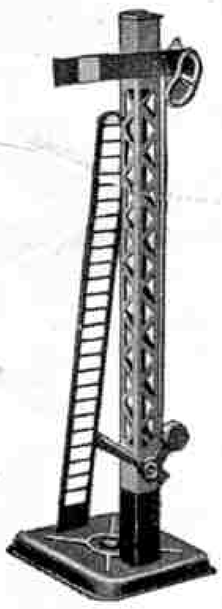




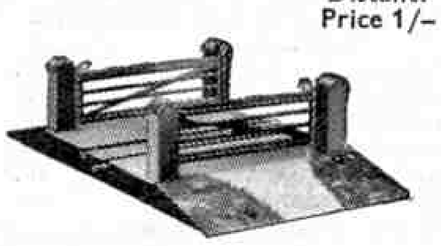
JUNCTION SIGNAL No. 1
Price 2/9



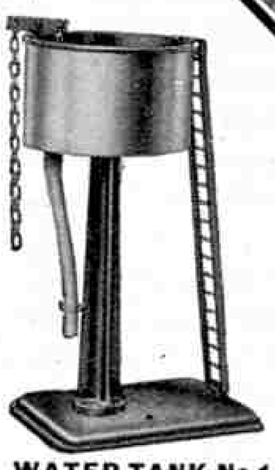
SIGNAL No. 1
"Home" or "Distant."
Price 1/–



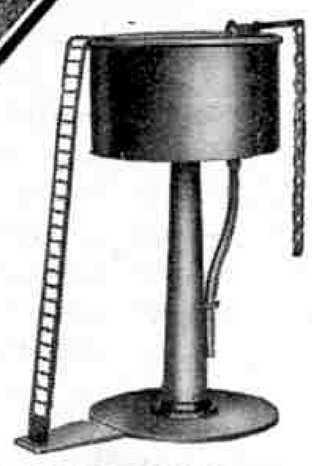
SIGNAL No. 2
"Home" or "Distant."
Price 2/–



LEVEL CROSSING No. 1
Suitable for a single track only and has gauge O rails in position.
Price 2/11



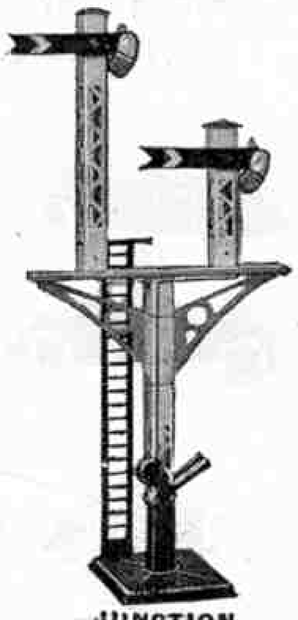
WATER TANK No.1
Height 7 in.
Fitted with flexible tube and valve lever.
Price 3/–



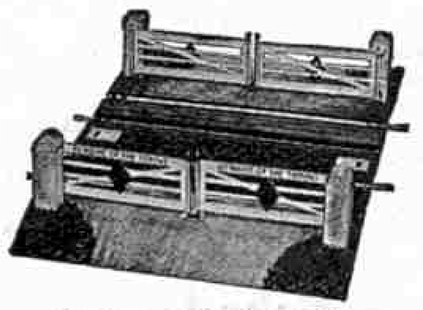
WATER TANK No.2
Height 9 in.
Fitted with flexible tube and valve lever.
Price 5/9

SIGNAL, DOUBLE ARM No. 1
Price 1/6

SIGNAL, DOUBLE ARM No. 2
Price 2/6



JUNCTION SIGNAL No. 2
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price 4/9

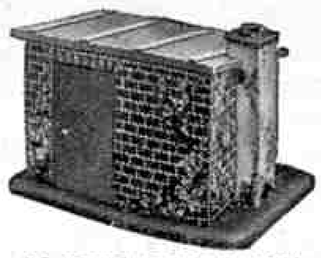


LEVEL CROSSING No. 2
Measures 13½ x 10¼ in., with two tracks of gauge O rails in position.
Price 5/6

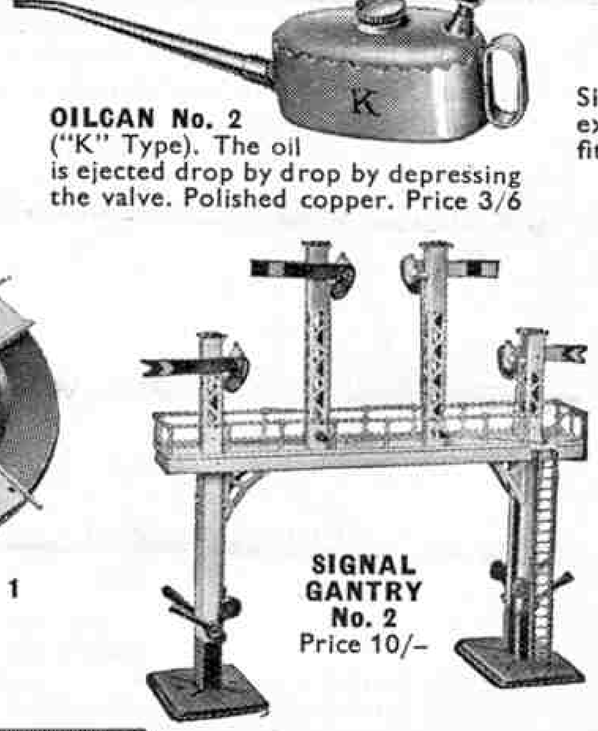
LEVEL CROSSING No. E2 (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price 7/6

No. 1 BUFFER STOPS
(Spring type)
Price 1/–

OILCAN No. 1
Price 6d.

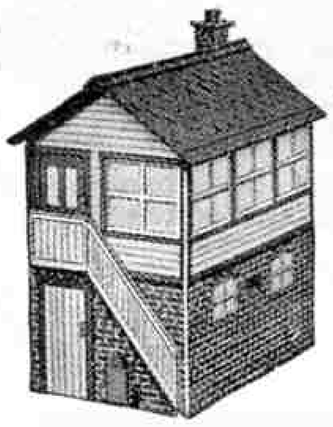


PLATELAYER'S HUT
Price 1/–



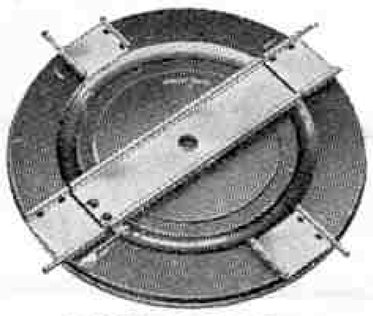
OILCAN No. 2
("K" Type). The oil is ejected drop by drop by depressing the valve. Polished copper. Price 3/6

MECCANO LUBRICATING OIL
Price per bottle 6d.



SIGNAL CABIN No. 1
Finished in colours.
Price 2/9

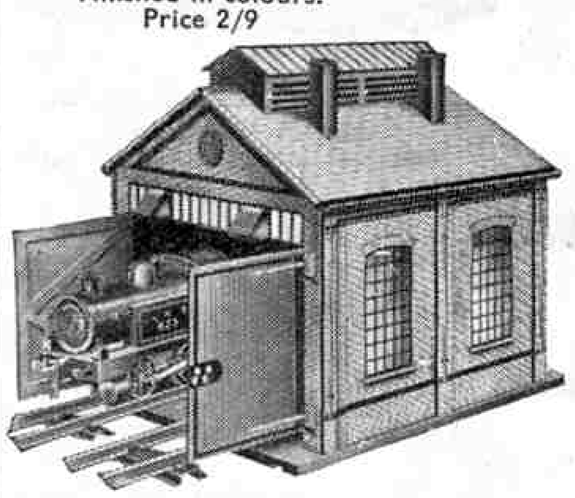
SIGNAL GANTRY No. 1
Price 4/11



TURNTABLE No. 1
Price 2/6

SIGNAL GANTRY No. 2
Price 10/–

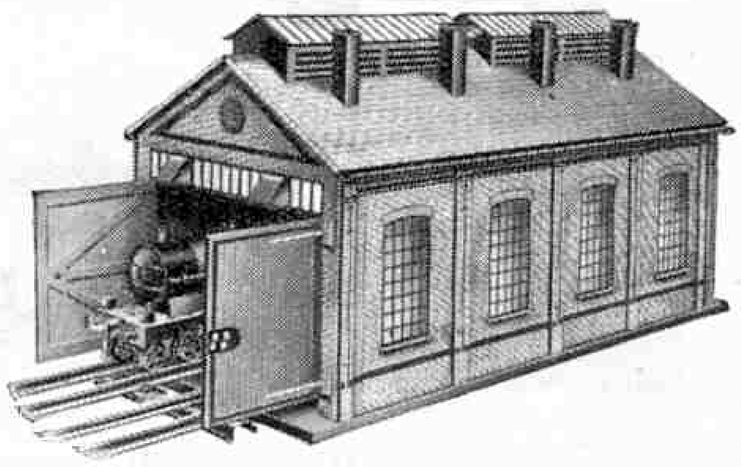
SIGNAL CABIN No. 2
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price 4/6



No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price 15/–

STATION No. 1
Length 16¾ in., width 6 in., height 6 in. Price 5/–

VIADUCT Price 6/6
VIADUCT Centre Section only ... ... Price 4/–
VIADUCT (Electrical) Price 7/6
VIADUCT (Electrical) Centre Section only ... ... Price 4/6



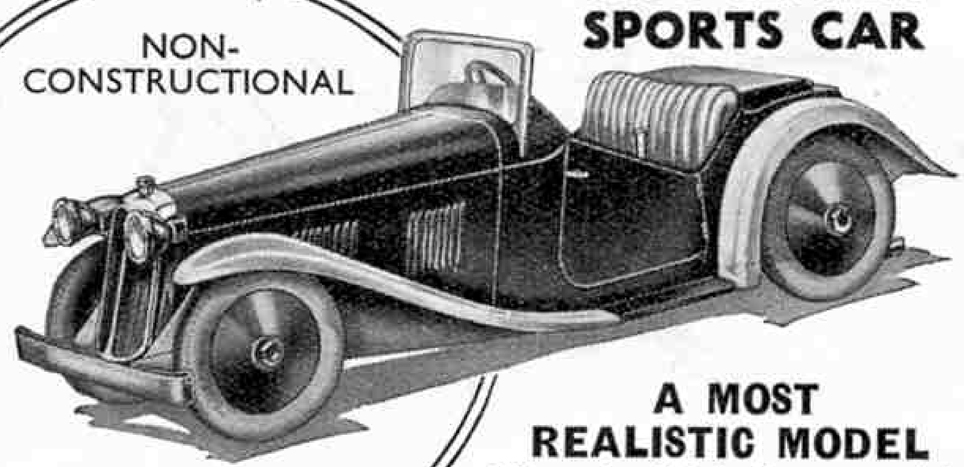
No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 17½ in.
Price 22/6

MECCANO LIMITED – BINNS ROAD – LIVERPOOL 13

MECCANO

TWO-SEATER SPORTS CAR

NON-CONSTRUCTIONAL



A MOST REALISTIC MODEL

This splendid built-up model represents the modern sports two-seater, a type of car that combines speed and excellent road-holding qualities, and has become increasingly popular during recent years. Speed is suggested by the sweeping lines of the bodywork and mudguards, together with the sloping radiator and wind-screen.

The model faithfully resembles its prototype in all important respects. It is complete in itself, no constructional or assembly work being required. It steers from the wheel, and is fitted with a strong clockwork motor that gives a long and steady run.

Overall dimensions: Length, 8¼ in.; Width, 3¾ in.; Depth 2⅞ in.

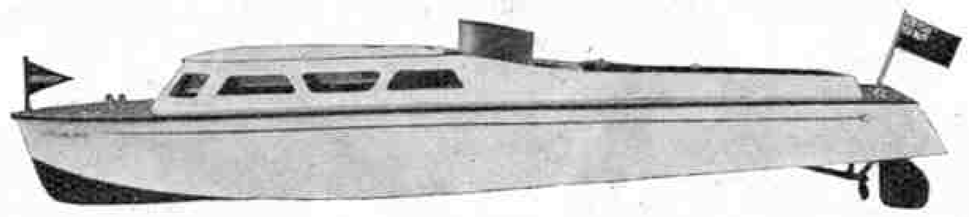
Price **6'6**

The model is beautifully made and finished, and is available in three different colours—Red, Blue and Green

Manufactured by

Meccano Ltd., Binns Rd., Liverpool 13

STREAMLINIA!



Recently there has been an unsatisfied demand for a commercially-made fast motor boat of modern design, and therefore we introduce "STREAMLINIA."

The first sample under test did more than 8 knots and ran continuously for nearly half an hour.

STREAMLINIA is metre size, with a shallow draught, only drawing ¾ inch of water when loaded. Her hard chine hull with "V" bottom is carved from the solid. She has a slipper stern and shell back deck giving a vivid impression of speed.

The finished model, with boiler, "Meteor" engine, Harrison type spirit lamp and Remod propeller, finished white with blue lines, costs **£9 9 0.**

We also have a complete set of parts for building this beautiful speed boat. Write for particulars.

Other new models are metre size working models of the *"Queen Mary"* and *"Normandie,"* and the Davis Turbine models *"Turbinia"* and *"Turbinette."*

Our scale model fittings for every type of marine model are all described in S.17, our new catalogue, Scale Model Ships, price 6d. post free.

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THE HOBBY OF TO-DAY

Make your own model aircraft (non-flying) with SKYBIRD components. SKYBIRD sets of parts are engineer-constructed, accurate in detail, and true-to-scale (1/72). They are of metal, wood and celluloid, not cardboard. There is also a wide range of accessories for planning and constructing aerodrome schemes, etc.

Illustrated above is the Gloster "Gauntlet." The set of constructive parts for this new model costs 2/6.

If you are interested in ships, you can make wonderful scale water-line models (1 in. to 100 ft.) from the SHIPSERIES range of components.

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3, Aldermanbury Avenue, London, E.C.2.

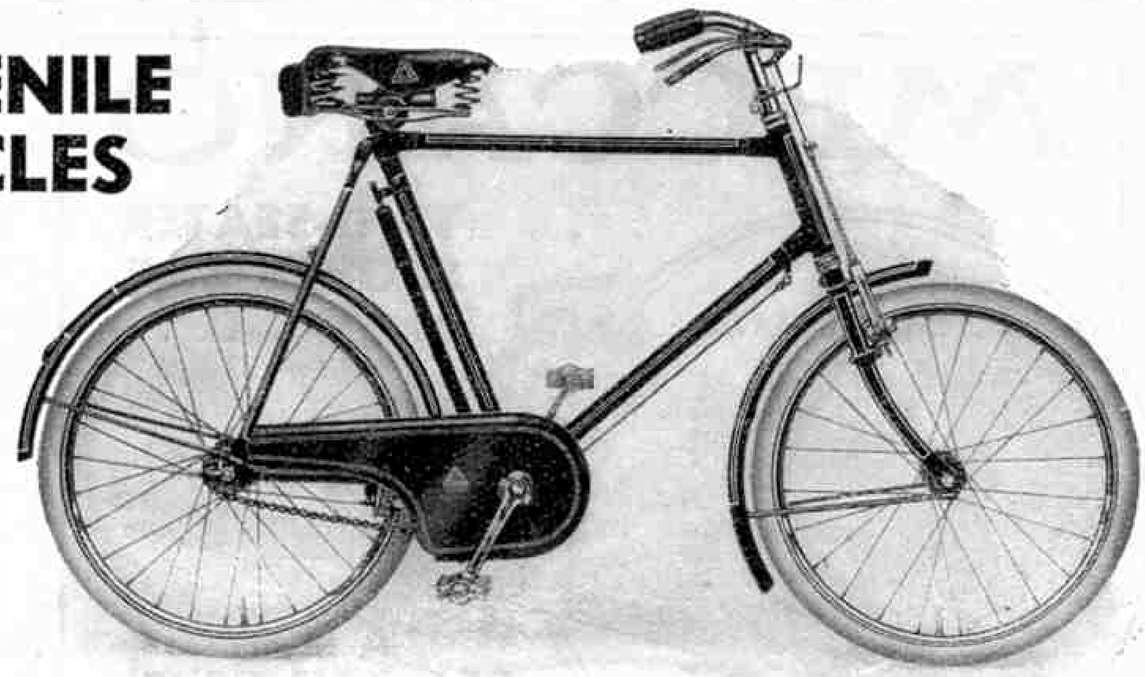
(a) Please send me full particulars and address of nearest agent.
(b) Please **also** send me latest copy of THE SKYBIRD for which I enclose 7d. in stamps.
Cross out either (a) or (b).

Name.....

Address.....

.....

JUVENILE CYCLES



JUVENILE CYCLE No. 9 (Boy's)

Frame of best quality weldless steel cycle tubing. Adjustable ball bearings throughout. 16 in. x 1⅜ in. Dunlop pneumatic tyres on rustless tangent spoked wheels. Two rim brakes. Raised Handlebars. ½ in. x ⅛ in. cycle roller chain. Three coil saddle. CHROMIUM PLATED FITTINGS. Black or blue. **57/6**

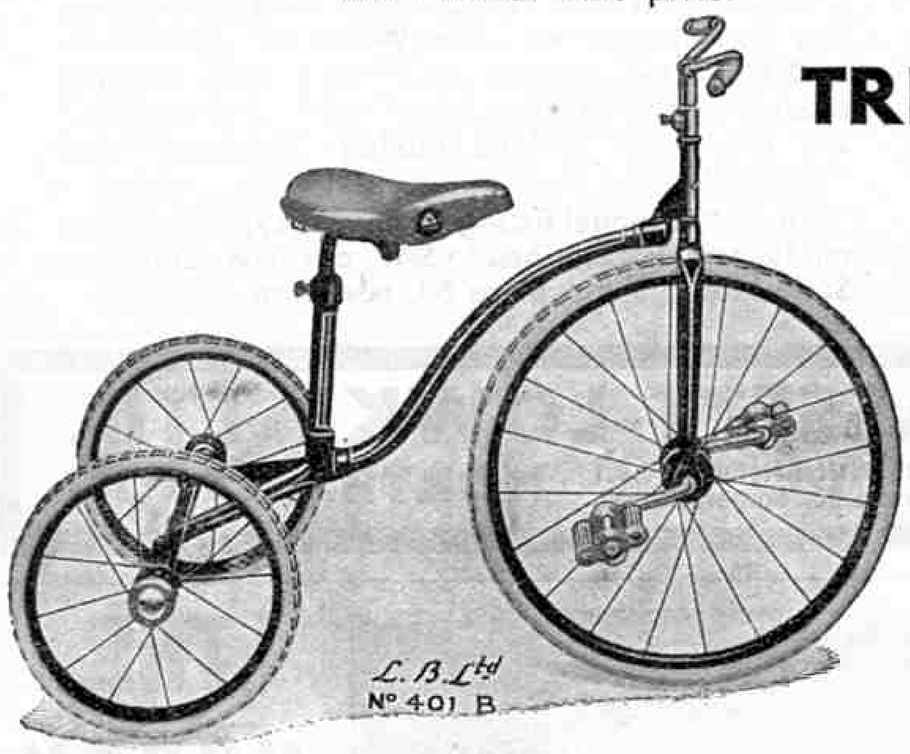
Girl's Model same price.

JUVENILE CYCLE No. 14 (Boy's)

18 in. Frame for ages 8–12. Finest quality British tube. 18 in. x 1⅜ in. Dunlop pneumatic tyres. Three coil leather saddle. ½ in. x ⅛ in. roller chain. Ball bearings throughout. Two rim brakes. Free wheel. **59/6**

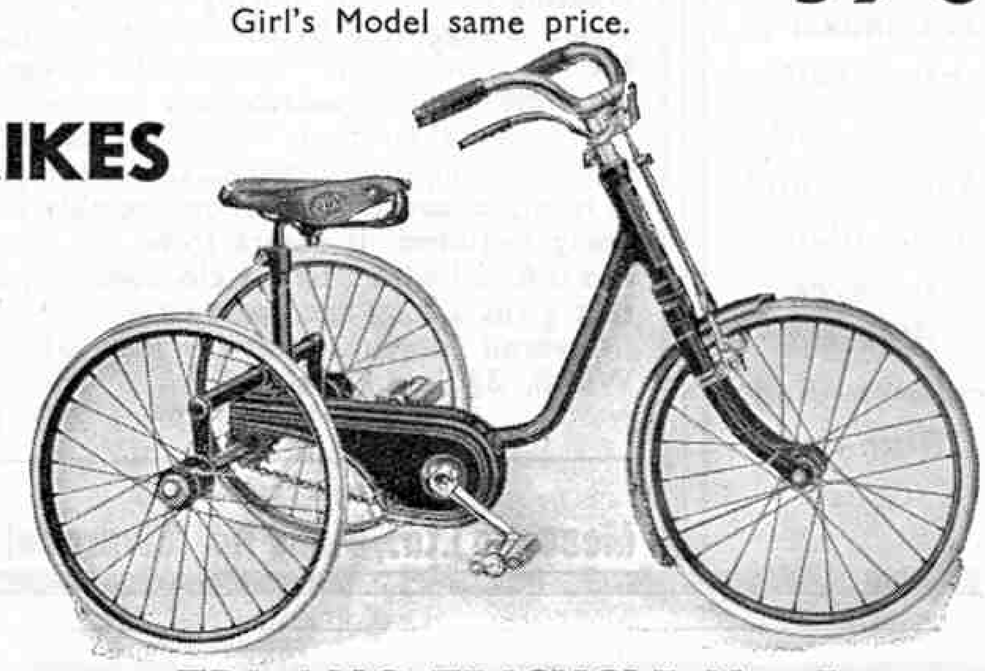
Girl's Model same price.

TRI-ANG TRIKES



TRI-ANG JUNIOR TRIKE No. 401B

Strong cycle tube frames. Enamelled black. Gold lines. Adjustable saddle. Thick white auto tread tyres. Nickel plated fittings. **21/9**



TRI-ANG TRICYCLE No. 5

Cycle chain drive with free wheel. Frame of best quality weldless cycle tubing. 14 in. wheels with 1⅛ in. sponge tyres. Rim brake. Ball-bearing pedals. Coil spring saddle. Finished black or blue cycle enamel. Gold lines. CHROMIUM FITTINGS. **59/6**

FAIRYCYCLES *and* SCOOTERS

FAIRYCYCLE (Regd.), MODEL No. 2

Tubular frame. 14 in. wheels. 1⅛ in. grey imitation pneumatic tyres. Ball bearing pedals. Rim brake. Two coil saddle. Chain cover. Stand. CHROMIUM PLATED FITTINGS. Black or blue. **39/6**

SCOOTER, MODEL D

Strong steel frame. Stove enamelled red. Nickel plated handles. Rubber grips. Tangent spoke wheels. 10 in. x ⅞ in. white ribbed tyres. Hardwood step, varnished and lined. Takes apart. **9/6**

ON SALE AT ALL GOOD TOY SHOPS, STORES, & CYCLE DEALERS **These prices are not applicable to Ireland**

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Editorial Office:
Binns Road, Liverpool 13
England

Volume XX. No. 3
March, 1935

With the Editor

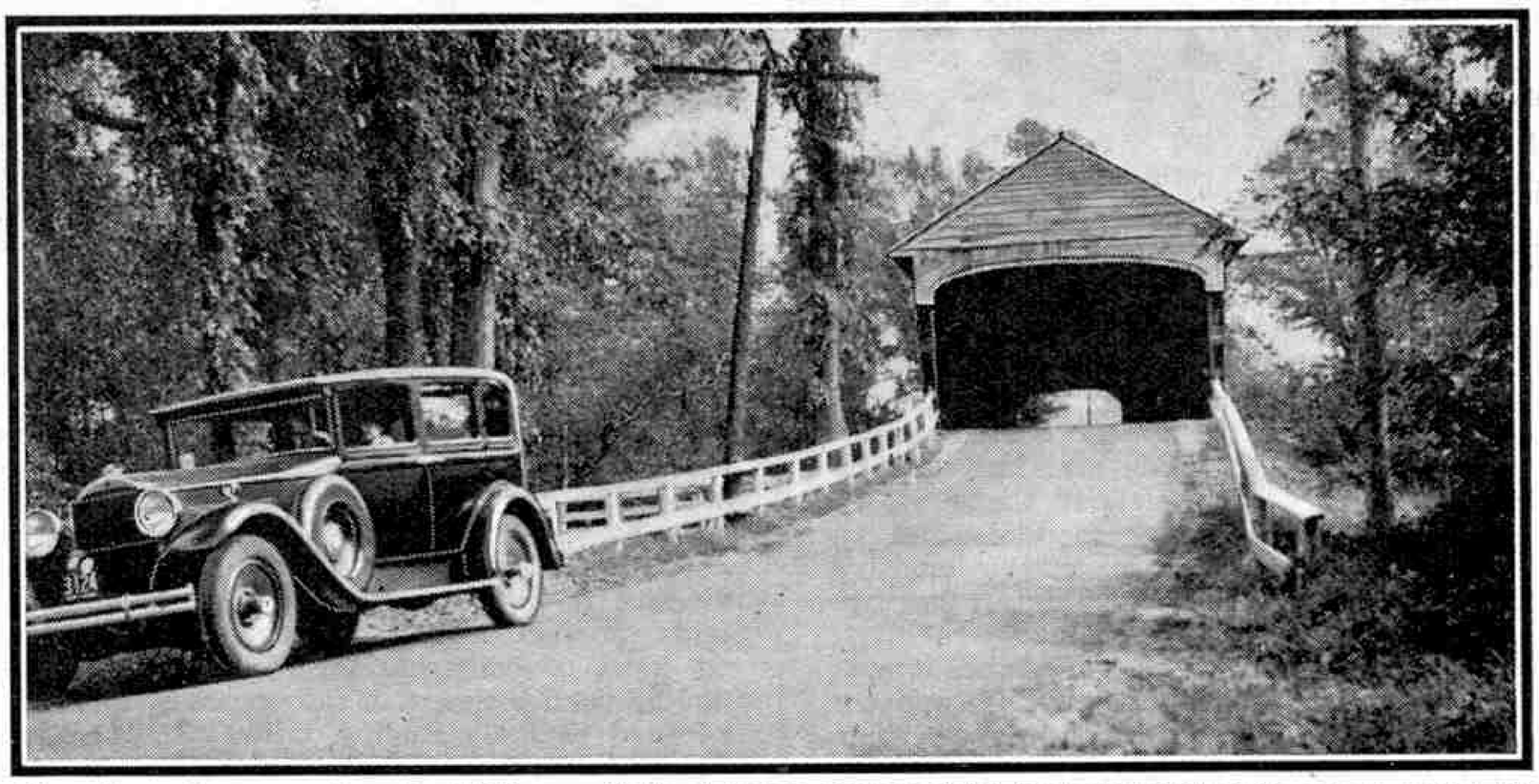
Historical Dates Worth Knowing

I wonder how many of my readers still suffer from the necessity of learning long lists of historical dates. I have been reminded of many painful episodes in my own school life that arose from my inability to appreciate the necessity for this dull part of history by a recent suggestion of Professor Bragg that there are many dates that are more important than those usually found in school history books. I suppose that some dates are necessary in order to provide a sort of framework for history, but I am sure that I should have been far more greatly interested if I had been asked to learn when the telescope was invented or the first steam locomotive was made, and not when the Kings of England died.

There would be a few difficulties to overcome in compiling a list of this kind, for certain great engineering achievements and inventions cannot be placed to the credit of one individual, and many inventions "grew up" instead of springing into existence fully grown on a definite date. I think the effort to work out such a list would be worth while, however, for it would be a splendid index to the growth of civilisation. For instance, in the 18th century emphasis would be laid on such dates as 1705, when Newcomen's atmospheric engine was patented, and 1765, when Watt's invention of the separate condenser greatly increased the efficiency and usefulness of the steam engine. The wonderful influence that these events brought about would be illustrated by reference to the introduction of Arkwright's spinning machine in 1769 and to the invention of the power loom by Cartwright, the patent for which was secured in 1785.

These developments would be followed by the application of the steam engine to locomotion. The chief dates in this connection are 1802, when Trevithick patented his first steam carriage, and 1803, when he built the first successful commercial locomotive, which hauled coal along a railway at Pen-y-Darran. Another date of importance is 1800, that of the invention by Trevithick of the high pressure steam engine. Some of these dates of course actually are in the 19th century, but they round off the story of the development of the steam engine and its application to industry that forms one of the outstanding features of the 18th century.

A few history books make short references to some of these important events, but most of them are more concerned with datés of orgies of destruction, such as the Battle of Blenheim, of agreements between great nations in the settlement of wars, of alliances that led to other conflicts, and of romantic but useless and wasteful episodes such as the effort of the Young Pretender to recover the throne of his ancestors.



The entrance to a covered wooden bridge near Portland, Maine. Bridges of this kind are typical of the eastern portion of the United States and of the adjoining Canadian provinces, where protection is needed in the severe winters experienced. Photograph by Miss Enid Wilson, Bowdon.

Careers in the Royal Air Force

No doubt many of my readers already know that the Royal Air Force is to be expanded by the formation of 41 new Squadrons. This means greater recruiting activity for the next four years and better prospects for boys eager to join this branch of the Services, and already the Air Ministry have announced that no fewer than 1,500 physically fit and well educated boys will be taken in this year instead of less than half that number, as in previous years.

The majority of the entrants are required as aircraft apprentices, to be trained in the technical schools of the Royal Air Force to become fitters, instrument makers and wireless operator mechanics. There are also openings for boy entrants, who are taught to be armourers, photographers and wireless operators, and apprentice clerks, who receive training in clerical duties. No previous experience is required for any of these positions in the Royal Air Force. The age limits for candidates vary between 15 years and 17½ years, and entrants are selected after examinations held at local centres throughout the country during the year.

Those of my readers who are attracted by the prospect of a career in the Air Force should write to the Air Ministry (Apprentices Department), Gwydyr House, Whitehall, London, S.W.1, for full details, and I shall always be glad to give them advice on any special difficulties that may arise.

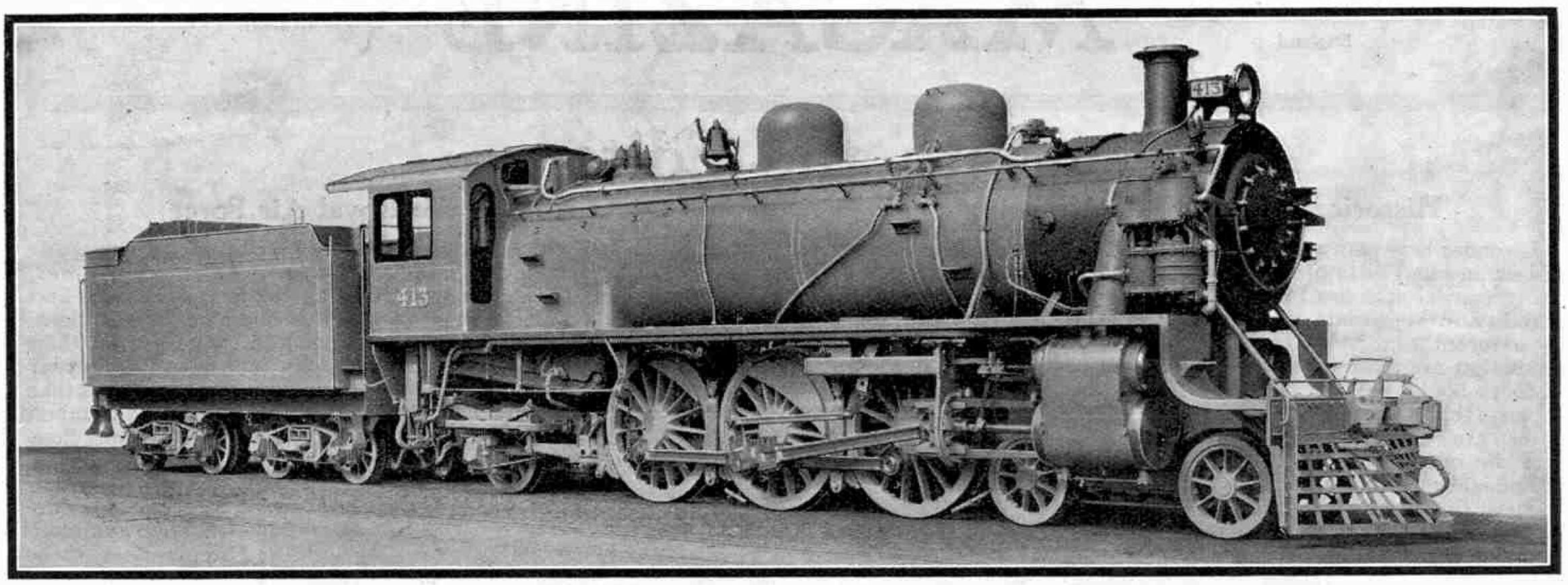
Lighthouses of the Sky

Last month I ventured to suggest that 1935 may mark the beginning of a forward movement that will make the air a great highway. A recent announcement by the Air Ministry seem to me to support this view, for it shows the growing importance of aviation, and suggests that further steady development of the airways of Great Britain can be anticipated.

This announcement deals with the establishment of new wireless stations at British airports. Stations of this kind are the lighthouses of the sky, for they give pilots their bearings and are especially useful in foggy weather. Plans therefore are being made for the establishment of a complete network of them by adding six more to the three that came into operation last year at Hull, Portsmouth and Newtownards, near Belfast, respectively. It is interesting to find that the wireless equipment to be used will be mounted on vehicles capable of being easily moved. This seems to be a wise plan, for the routes to be followed by our internal air lines are not yet settled, and changes in the positions of the wireless stations can be made rapidly as these develop.

Shipping Giant Locomotives

Interesting Methods of Transport



IN the early days of railways, when there was a great number of small systems, most of them had to have their locomotives built by one or other of the firms specialising in this branch of engineering. Frequently this led to the appearance on several separate lines of similar engines, these being standard designs of the particular firms concerned. Throughout their history those railways not possessing the necessary facilities had to pursue this course systematically, although an odd locomotive was perhaps sometimes produced in the workshops otherwise devoted to repairs.

The bigger systems, however, developed large establishments of their own for locomotive and rolling stock building, and for the most part manufactured their own stock, although some supplemented their own productions by placing orders with outside firms. War and post-war conditions caused even companies that had built their own stock regularly for many years, such as the former London and North Western, to employ this latter method, and in the re-organisation period of the earlier grouping years some large orders were carried out for the L.M.S.R. and L.N.E.R. groups. This year, again, the L.M.S.R. group have large contracts placed with different firms for the delivery of locomotives of both steam and Diesel patterns.

The illustration above shows a 4–6–2 express locomotive for service on the Tientsin-Pukow Railway of China. This was one of a number constructed by the North British Locomotive Co. Ltd. of Glasgow, to whom we are indebted for the illustrations and for much of the interesting information contained in this article.

Even when a company is able to build its own engines, it is of advantage for it to have the work done "out" when a particular kind of locomotive is required to perform special duties. For example, the "Beyer-Garratt" locomotives of the L.M.S.R. and the L.N.E.R. are a special production of Beyer Peacock and Co. Ltd. Narrow-gauge engines also are invariably produced by specialist building firms.

The conveyance of standard gauge engines from the builders' works to the railway company concerned does not as a rule occasion any great difficulty. Where the works are on another company's system, many miles away from the line to which the engines are consigned, they may be forwarded "dead" as a complete train of engines, or perhaps as part of a through goods train. Coupling and connecting rods, after final assembly at the makers' works, are taken off for travelling, and are refitted by the railway staff when the engines are put into service. The most spectacular example of the first method of delivery—as a complete train—was seen in America some years ago when 20 giant "Santa Fé" or 2–10–2 type locomotives, built by the Baldwin Locomotive Works for the Southern Pacific Railroad, were moved intact as one train right across the Continent. They formed the most notable train of railway motive power that ever moved, with a total length of about 2,000 ft., and a weight of approximately 4,000 tons!

The shipment and delivery of locomotives built by British firms for service overseas presents special problems. The majority of foreign and Colonial railways are of a different gauge from our own systems, and even where the gauge is identical, railways abroad frequently have a more liberal construction gauge, which renders it difficult and sometimes impossible for locomotives built for such lines to be transported over British railways to the port of embarkation. This of course is the result of our having been pioneers in railway construction. The narrow limits adopted by early English railway builders remain to-day, except where it has been possible to increase them by special widening operations.

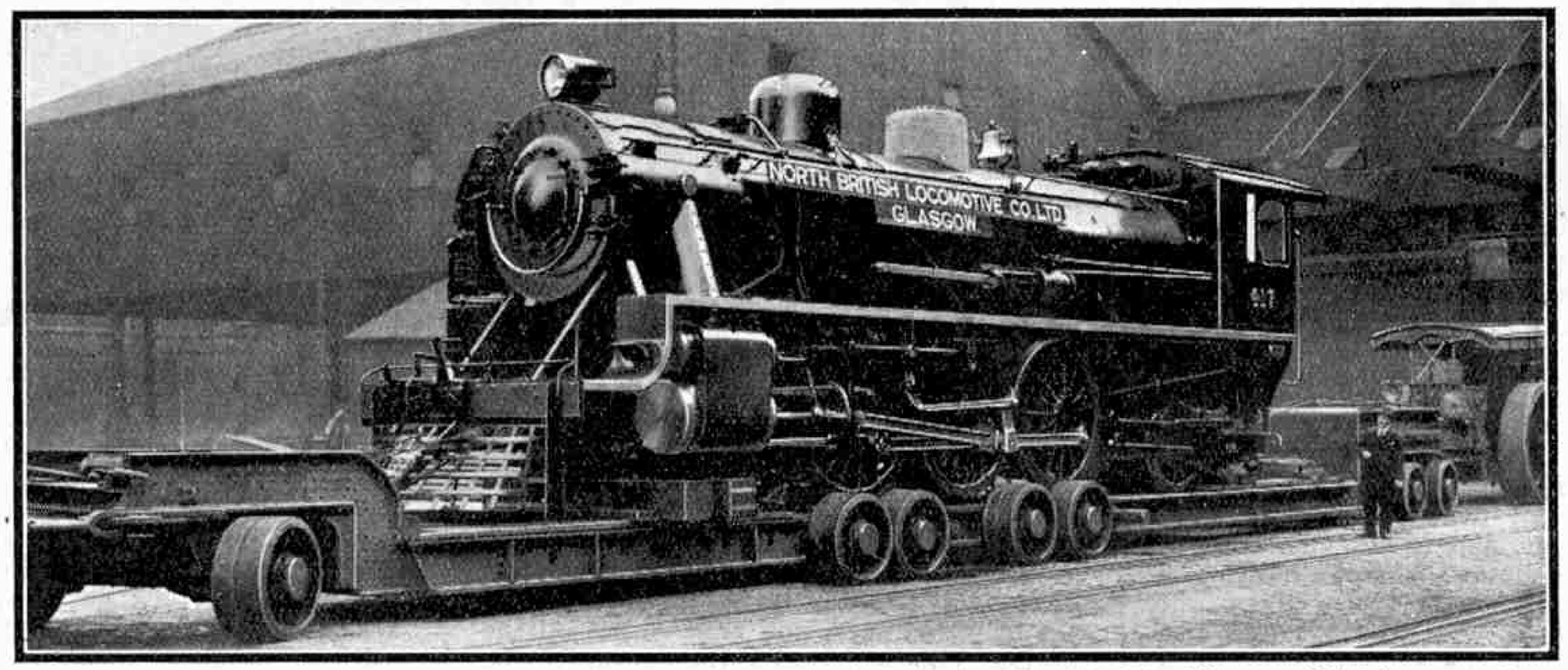
For cases where rail transport of locomotives for shipment is possible, the L.M.S.R. put into service some time ago a couple of very interesting trolley wagons. To facilitate the end-loading and unloading of locomotives the vehicles are made in detachable sections, and rails fitted on the centre girder section are adjustable for different gauges. The vehicles consist essentially of two end cantilever sections each carried on a six-wheeled bogie with the centre load-carrying girder portion slung between them. For loading purposes one or other of the end sections is removed, the girders and load then being supported by powerful hydraulic jacks. Locomotives weighing up to 65 tons can be carried by these special wagons.

Until a few years ago locomotives manufactured in this country for shipment were dismantled after testing in the makers' works, and the smaller details, such as coupling and connecting rods, valve motion, springs, brake gear and boiler mountings, were carefully packed in zinc-lined cases to ensure that no damage occurred in transit. Recently, however, it has become the custom to ship locomotives completely erected; and as few of the locomotive builders in this country have works provided with quayside accommodation it has been necessary to have recourse to rather unusual methods of transport.

The difficulty of taking locomotives by rail has necessitated the employment of road transport, and as an example the locomotives shown in the illustrations in this article were loaded on giant trolleys running on a large number of rubber-tyred wheels. They were hauled through the streets by two traction engines, and a third trailed behind to assist in controlling the

vehicle when negotiating sharp corners during the journey.

The locomotives illustrated in two of our photographs were built by the North British Locomotive Co. Ltd., of Glasgow, for the Tientsin-Pukow Railway of China, and as it was impossible, owing to the restrictions of tunnels, to convey them to the docks by any of the available railway routes, they were taken by road. It was necessary to remove the chimneys, which were too high to pass below a railway bridge on the route. Incidentally a comparison of the photographs showing engines with and without chimneys respectively shows what an effect on the appearance of a locomotive this fitting has. The items next in height, the sand-box and the dome, only cleared the bridge in question by a couple of inches. At the docks the engines were lifted by an enormous hammerhead crane belonging to the Clyde Trust, and were placed on board the vessel that was to convey them to China.



A locomotive of the class illustrated on the previous page on its way to the docks for shipment. The chimney and the dome cover have been removed owing to limited overhead clearances.

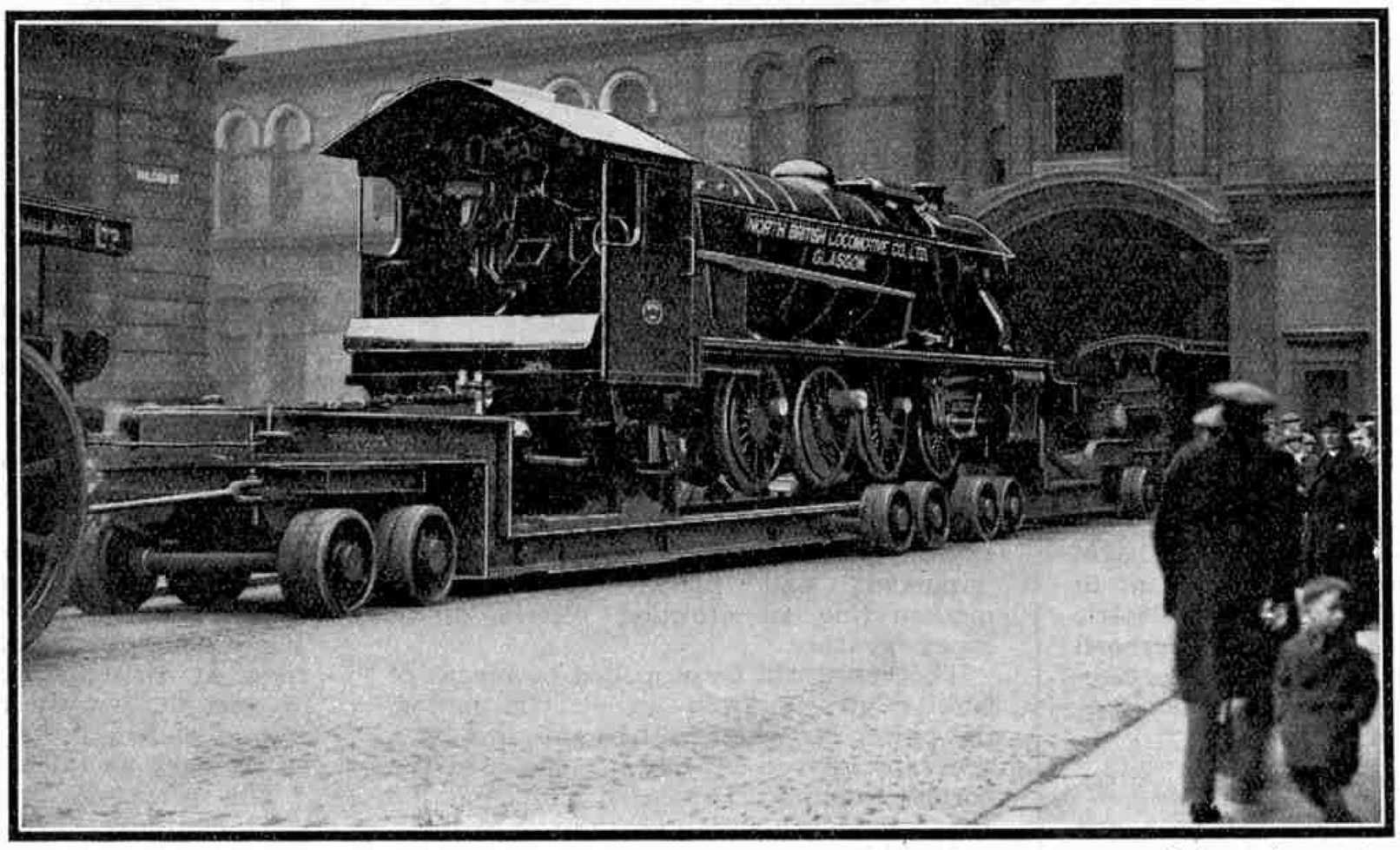
These engines are of the 4–6–2 or "Pacific" wheel arrangement. They have two outside cylinders, with a bore and stroke of 20 and 28 in. respectively, connected to the centre pair of six-coupled driving wheels, 5 ft. 9 in. in diameter, which are disposed in a rigid wheelbase of 12 ft. The boiler has a total heating surface, including that of the superheater, of 2,390 sq. ft., and supplies steam at 200 lb. per sq. in. to the cylinders. The grate area is 43.5 sq. ft., and the tractive effort at 85 per cent. of the working pressure is 27,600 lb. The bogie tenders have a water capacity of 5,289 gallons, and the coal space accommodates 9.84 tons.

The total weight of each engine in working order is 90 tons 10 cwt., of which 52 tons 12 cwt. rests on the coupled wheels. The tender fully loaded weighs 57 tons 8 cwt., and the complete weight of engine and tender is 147 tons 18 cwt. Special fittings are often specified for locomotives intended for service abroad, and among those supplied in this instance may be mentioned the "Pyle-National" system of electric lighting for the powerful headlamp, a cross-compound air compressor for the Westinghouse brake equipment, and "Alco" power reverse gear.

The 2–8–2 or "Mikado" locomotive illustrated in the other photograph is one of several also built by the North British Locomotive Co. Ltd., for H.E.H. The Nizam's State Railways in India. The photograph shows this engine being taken by road prior to shipment, fully erected, in the Ellerman's "City" Line vessel "*City of Barcelona*," and the limited clearance between the chimney and the archway is very apparent. These "Mikados" have two large outside cylinders 22½ in. in diameter by 28 in. stroke, driving on to the third pair of coupled wheels. These wheels are 5 ft. 1½ in. in diameter, and in the photograph the method of protecting the crank pins during shipment will be noticed. The total heating surface including the superheater is 2,716 sq. ft., and the grate area of the wide fire-box is 45 sq. ft. The weight of the engine and tender in full working order is 170 tons.

It is interesting to note that two of the engines are equipped with mechanical stokers designed by the builders, and one of these two is also fitted with an auxiliary steam engine or booster driving on the wheels of the trailing radial truck. With the booster in operation the tractive effort is increased from 35,264 lb. to 43,192 lb. The booster-fitted engine is also provided with a feed-water heater of the A.C.F.I. pattern.

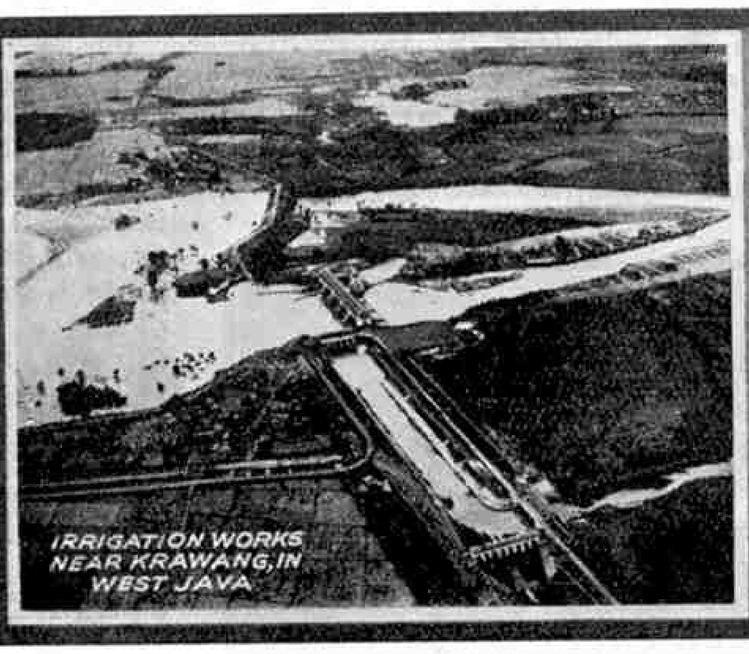
There are very few locomotives in this country provided with such large boilers that the amount of fuel consumed is too great to be fired effectively by hand. Many railways overseas, however, are unable to take the greatest advantage of the steam-raising capacity of their large-boilered engines without some mechanical device to take the place of the fireman. As the speed at which heavy loads can be hauled depends upon the quantity of steam generated in the boiler, some form of mechanical stoker is practically the only solution to the problem of dealing with heavy loads effectively at the required speeds.



A "Mikado" or 2–8–2 locomotive for India emerging from Hyde Park Works. Its road transport before shipment is evidently arousing considerable public interest.

Several British steamship companies, notably the Ellerman's "City," Clan, and Elder Dempster Lines, have recently built vessels with hatches of suitable dimensions to admit of really large locomotives being lowered into the hold, and these ships are also equipped with high-capacity derricks to enable the locomotives to be discharged at ports that do not possess sufficiently heavy quayside cranes. The work of securing the locomotives in the hold of the vessel must of course be effected very thoroughly, as it would be disastrous if such heavy pieces of machinery began to move about during a storm.

Prominent among vessels for the sea transport intact of locomotives, rolling stock and similar equipment, is the fleet of ships owned and operated by S. A. S. Christen Smith's Rederi, of Oslo, Norway, that has become famous in the last few years. The motor vessel "*Beldis*," built in the Walker shipyard on the Tyne of Sir W. G. Armstrong Whitworth and Co. Ltd., (*Cont. on p. 144*)



ENGINEERING NEWS

Harbour Developments in China

In connection with the work of developing a new port at Honan in China for the Chinese State Railways, a coal-handling plant capable of dealing with 400 tons of coal per hour, and of carrying a stock of 167,000 tons of coal, is to be built. The work of construction is being carried out by a British firm, which has secured also the contract for the construction of a complete power plant and handling equipment for general merchandise.

The coal storage, reclaiming and shipping plant will be provided with a special wagon tippler capable of dealing with trucks carrying between 10 and 40 tons of coal. This machine will tipple incoming coal on to moving belts that will carry it to a stock pile, or store, 1,600 ft. in length and 600 ft. high. Another conveyor will be arranged below this pile to carry off coal, as required, direct to the wharf, where ships will be loaded by a big travelling tower.

The power station that is to be installed at Honan will eventually be able to generate about 2,000 kW. It will be equipped with four steam turbo-alternators, but only two of these are to be installed to begin with. The merchandise handling plant of the port will include three 3-ton electric level-luffing cranes, four 2-ton overhead travelling cranes, two 2-ton mobile electrical cranes and six gravity roller conveyors each 24 ft. in length.

A Streamlined Fire Engine

A motor fire engine that has been put into service by the Lancaster Fire Brigade is partially streamlined and is provided with enclosed seats for all the firemen. Entry and exit are gained by two doors on each side of the machine. All the windows are arranged to slide down. The fire escape is carried on the roof of the vehicle, and there is a special compartment for the usual fire-fighting gear, which includes a powerful lighting set and a searchlight that can be employed either on or off the machine. The interior has two side seats and a cross seat, all of which are arranged as hose lockers.

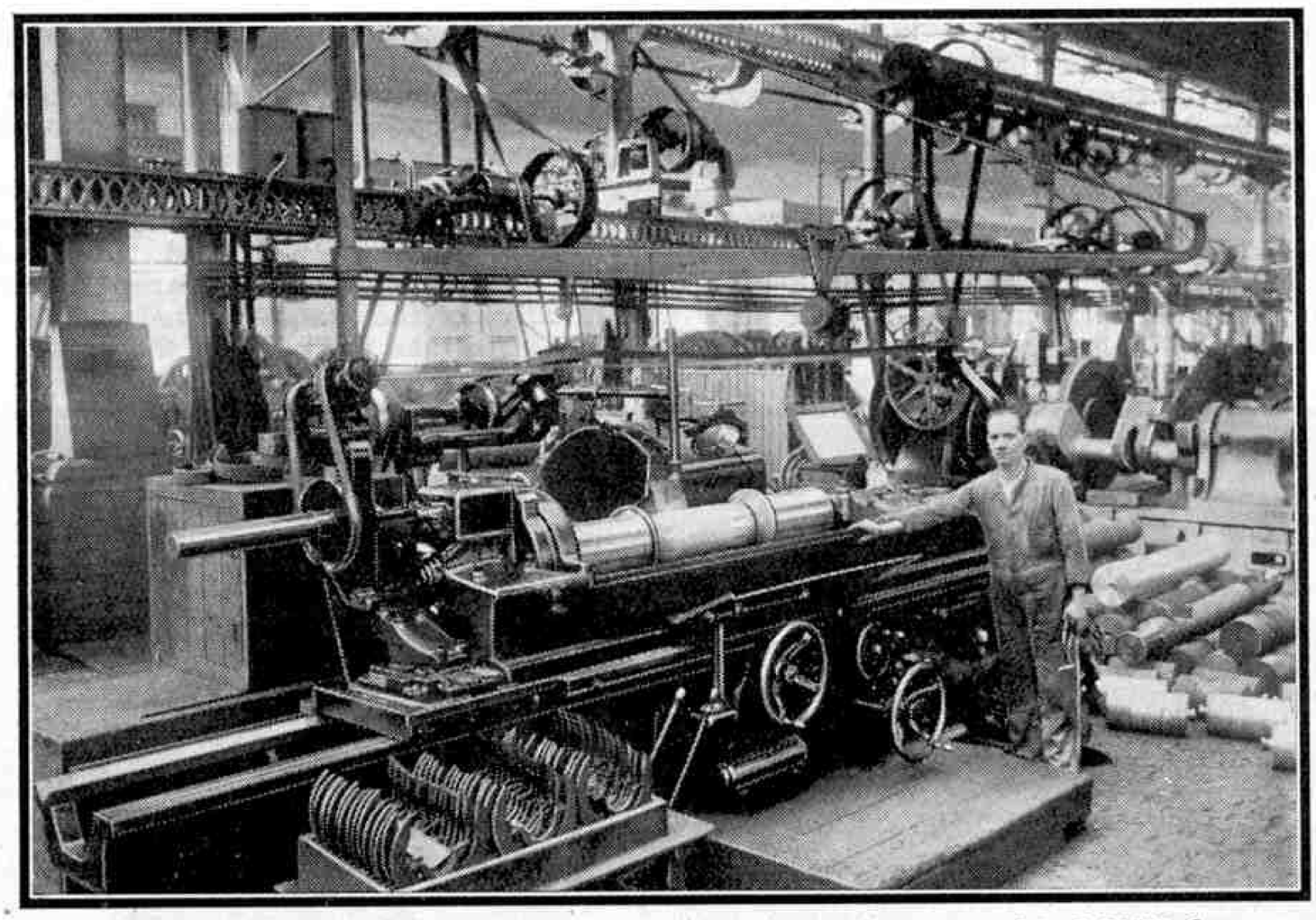
Dual Control for Paddle Ship

A Diesel-electric paddle ship that is now being built for the L.N.E.R. for service on the company's routes on the Clyde, will be fitted with dual controls of the propulsion machinery. The vessel, which is to be named the *"Talisman,"* will have one set of controls situated in the engine room in the usual manner, and another set on the bridge. This will enable the captain to be in complete charge, and to control the engines instantly if he wishes to, a very important and useful feature when manœuvring in crowded waters or in foggy weather.

The vessel will be propelled by means of paddles driven from an electric motor, the power for which will be supplied by a generator driven by Diesel engines in the normal manner. The new ship will be 215 ft. in length with a beam of 27 ft. 6 in., and will have a speed of 17 knots.

Transmission Line with Span of 2,140 ft.

A transmission line carrying current at 33 kW. has recently been erected across the Weaver Valley, Wallerscote, near Northwich, with an uninterrupted span of 2,140 ft. Two towers 65 ft. in height were constructed to carry the line and they are arranged to serve also as suspension towers. They are 81 ft. 3 in. in overall height and 73 ft. 3 in. in height to the lowest conductor. The towers are each braced by three stays.



Grinding locomotive axles at the Crewe Locomotive Works. Photograph by courtesy of the L.M.S.R. Company.

The Kut Barrage Scheme

The contract for the construction of the swing bridges, lock gates and sluice gates required for the Kut Barrage scheme in Iraq has been awarded to the British firm of Ransomes and Rapier Ltd. Some 56 sluice gates will be required, in addition to five or six lock gates and two swing bridges. More than 3,600 tons of metal will be used in meeting the contract, work on which has already been started.

The Kut Barrage will be nearly 2,000 ft. in length, and the 56 openings with which it will be provided will each be about 20 ft. wide. The dam will be 50 ft. in height and will carry a roadway 13 ft. wide. The scheme also involves the construction of a navigation lock 260 ft. long and 53 ft. wide, and a canal 3,250 yds. in length and 90 ft. wide.

Proposed New Bridge for Brisbane

A project for the construction of a high-level bridge across the Brisbane River at Brisbane is now receiving consideration by Australian engineers. The bridge would be built at a place called Kangaroo Point, and would be of great value in joining up the business and commercial area of the city, which is on the north of the river, with the residential districts on the south. There are already two bridges across the river at Brisbane, but the construction of yet another at Kangaroo Point was recommended by a special Commission as far back as 1926.

The proposed bridge is of the high-level cantilever type and would have a single span of about 900 ft. with a clearance above high water of at least 100 ft. It would carry a roadway 40 ft. in width, in addition to two 10 ft. paths, and would be designed so that if in the future traffic conditions necessitated the widening of the road to 60 ft., two 10 ft. footpaths could be carried on cantilever tracks on each side of the structure.

The estimated cost of the construction of the bridge, and the replanning of streets in the immediate neighbourhood of the proposed structure is about £1,700,000.

A 340-Mile Aqueduct in America

On page 73 of our last issue we gave details of the San Francisco water supply scheme that involved the construction of a long aqueduct. Another big American project similar to this is well advanced, and when completed will provide for the delivery of water from the Colorado River to Los Angeles, 240 miles away, in addition to supplying other towns in the neighbourhood, which will add about 100 miles to the pipe line.

The water for the scheme will be stored in the Cajalco Reservoir, to which it will be pumped from the river. The highest point of the aqueduct is 2,000 ft. above sea level, and of the 240 miles of the main aqueduct 91 have been tunnelled through rock. This is not all in one length, but is split up into 30 small tunnels, the longest being 18½ miles. The tunnels have been driven to a diameter of 16 ft.

Important New By-Pass Road

One of the biggest by-pass schemes that have ever been contemplated in this country is to be started shortly at Winchester, where the main London to Southampton, Portsmouth and Bournemouth road will be taken clear of the city, the streets of which are exceedingly narrow and sometimes cause traffic jams lasting for miles. Some idea of the amount of work entailed in the scheme can be gained from the fact that it involves moving about 1,000 yds. of the G.W.R. line, in addition to the construction of a railway bridge under the Southern Railway and the building or widening of other bridges.

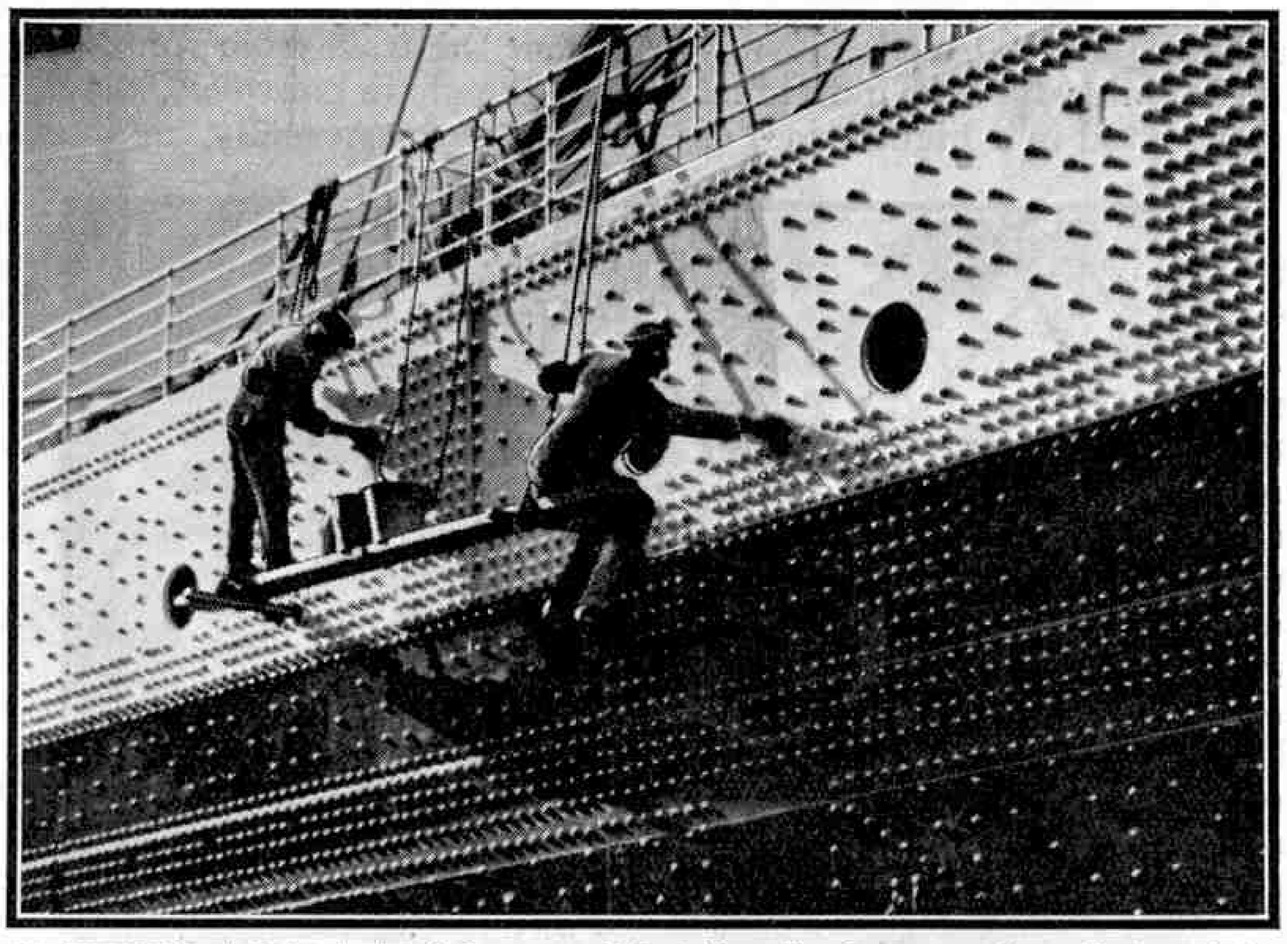
It has not yet been decided whether the new by-pass will take the form of a single road 80 ft. wide or two narrower one-way roads divided by a central strip. In any case it will be about 7½ miles in length, and will leave the present road at King's Worthy, about 2½ miles north of Winchester, and will rejoin it at Compton, some three miles south of the city. The work will cost about £360,000.

The by-pass scheme is another step in the construction of a wide and unobstructed highway from London to Southampton and the West of England. The towns in this part of the country are all very old, and are consequently full of narrow and tortuous streets. About £1,500,000 has already been spent in building by-pass roads round these towns, notably at Kingston and Guildford.

New B.T.H. Turbo-Alternators

The British Thomson-Houston Co. Ltd., Rugby, have recently received orders for several turbo-alternator generators for installation in English power stations. The largest order is for a 75,000 kW plant for the Barking "B" Power Station, which represents the third machine of this type manufactured by the B.T.H. Co. Ltd., for this station. Other important orders on the books of this firm are for a 50,000 kW 33,000 volt turbo-alternator to be installed at the Kearsley station of the Lancashire Electric Power Co. Ltd., and a 30,000 kW plant for the Derby and Notts. Electric Power Co. for the Spondon power station.

The transfer hoist for the front and rear axle conveyor in the Cowley assembly plant of Morris Motors Ltd., to whom we are indebted for the illustration. A special article on this plant appears on page 138.



An impressive photograph showing men repainting the side of an ocean liner. Photograph by courtesy of our reader, Sidney Garbutt, Altrincham, Cheshire.

Maiden Voyage of the "*Normandie*"

It is announced that the great French liner "*Normandie*" will make her maiden voyage on May 20th next. She will call at Southampton on the outward trip, and at Plymouth coming back. Her progress will be watched with keen interest.

Beauharnois Power Development

In our issue for April 1934 we published an article dealing with the Beauharnois Power Station, one of the most extensive projects of its kind that have been undertaken in any part of the world. The station is continually being expanded to bring it up to its maximum output, and the operating company that own it now deliver 204,000 h.p. of electrical energy under contracts with the Montreal Light, Heat and Power Consolidated, and the Ontario Hydro-Electric Power Commission. By October 1937 this total will have been increased to 400,000 h.p., and eventually the Beauharnois Power Corporation will own a plant capable of developing more than 500,000 h.p.

The new canal that was described in our article now takes about a quarter of the flow of the St. Lawrence River, and will shortly complete the final link in the canalisation for deep-water vessels of the Canadian sections of the St. Lawrence River, except for a short section near Montreal.

Dredging for Gold

A new gold dredger that has been put into service in California is capable of working down to a depth of 150 ft. It is 234 ft. long, 68 ft. wide and 12 ft. deep, while the ladder supporting the buckets is 200 ft. long and is provided with an idler, 10 ft. in diameter, half way along on the under section. The buckets, of which there are 126, have a capacity of 18 cu. ft. and are made of manganese steel. They are arranged so that the material they bring up is dropped into a hopper, from which it is fed on to a revolving screen. From here the waste material left after the gold has been extracted is carried ashore on a moving belt supported on a movable boom 250 ft. in length. The dredger is operated by two motors, the ladder hoist and bucket chain being driven by one of 160 h.p.; while a 75 h.p. motor is provided for auxiliary purposes.

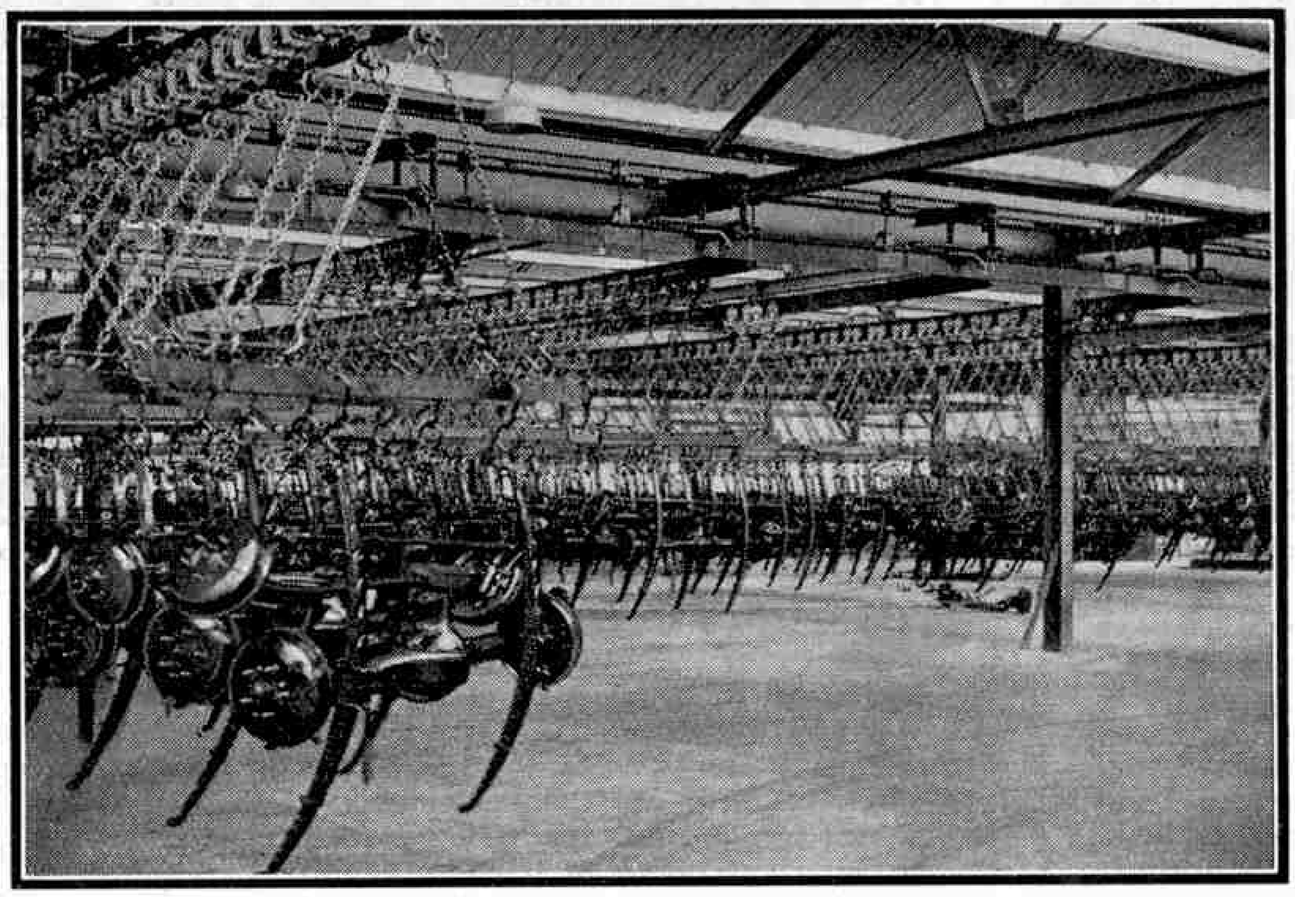
It is some time since gold dredging was carried out in California, as all the best ground has already been worked. With the present great increase in the price of gold, however, deposits that previously could not be worked at a profit are now well worth reopening and there is a renewal of activity in some of these goldfields.

Europe's Most Modern Car Assembly Plant

A Triumph of Specialised Production

THE design and construction of motor cars are continually undergoing a steady process of development and improvement, but a revolution has taken place recently in the equipment of factories to produce them in quantities.

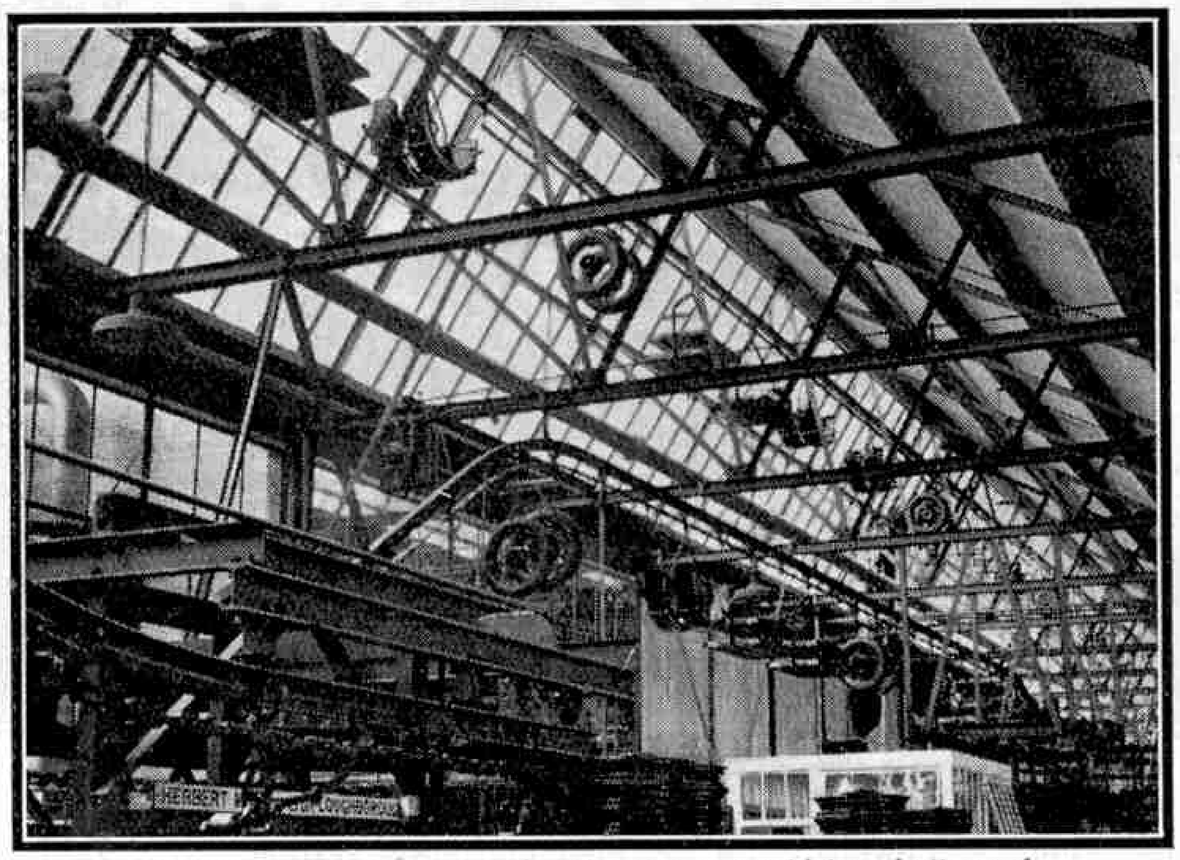
In each distinct department of car production by Morris Motors Ltd., whose head office is at Cowley, Oxford, processes have been mechanised to a remarkable degree. The foundry is the only mechanical casting plant for motor car parts in Europe. The engines branch in Coventry is the largest specialised engine plant in Europe; and the assembly plant at Cowley is the only one of its kind in the world.



Front and rear axles stored on overhead conveyors until required in the main erecting shop of the Cowley assembly plant of Morris Motors Ltd., to whom we are indebted for the illustrations to this article.

Although Morris cars had always been assembled in large quantities at Cowley, the laying down of specialised equipment, at a cost of £250,000, made possible still greater production, and the ability for each individual workman to specialise. This resulted in a higher class of product than even Morris had previously produced. It is this plant that will be described in this article.

Bearing in mind that Cowley is merely an assembly plant fed by specialist factories, the very complete organisation of the stores must claim our first attention. These are situated in a building separated from the assembly lines by a works road, but connected by two bridges. The stores accommodate sufficient components for two weeks' output. All components, with the exception of chassis frames and engine and gear-box units, are delivered to a loading dock.



Various motor car parts passing along conveyors high up in the roof.

Provision is made in this department for the sub-assembly of front and rear axles ready for spray painting. Sub-assembly takes place on lines that finish near an electric hoist. The complete axles are then hoisted to overhead runways that convey them to spray painting booths. As the back axles reach the booth, they are sprayed from opposite sides, and then carried through a drying oven maintained at a temperature of 200 deg. F. After 40 minutes, they are fed to the storage section, ready for supply to the chassis lines in the main erecting shop. A chain conveyor takes them across the bridge and round the latter shop to a platform arranged above the main lines.

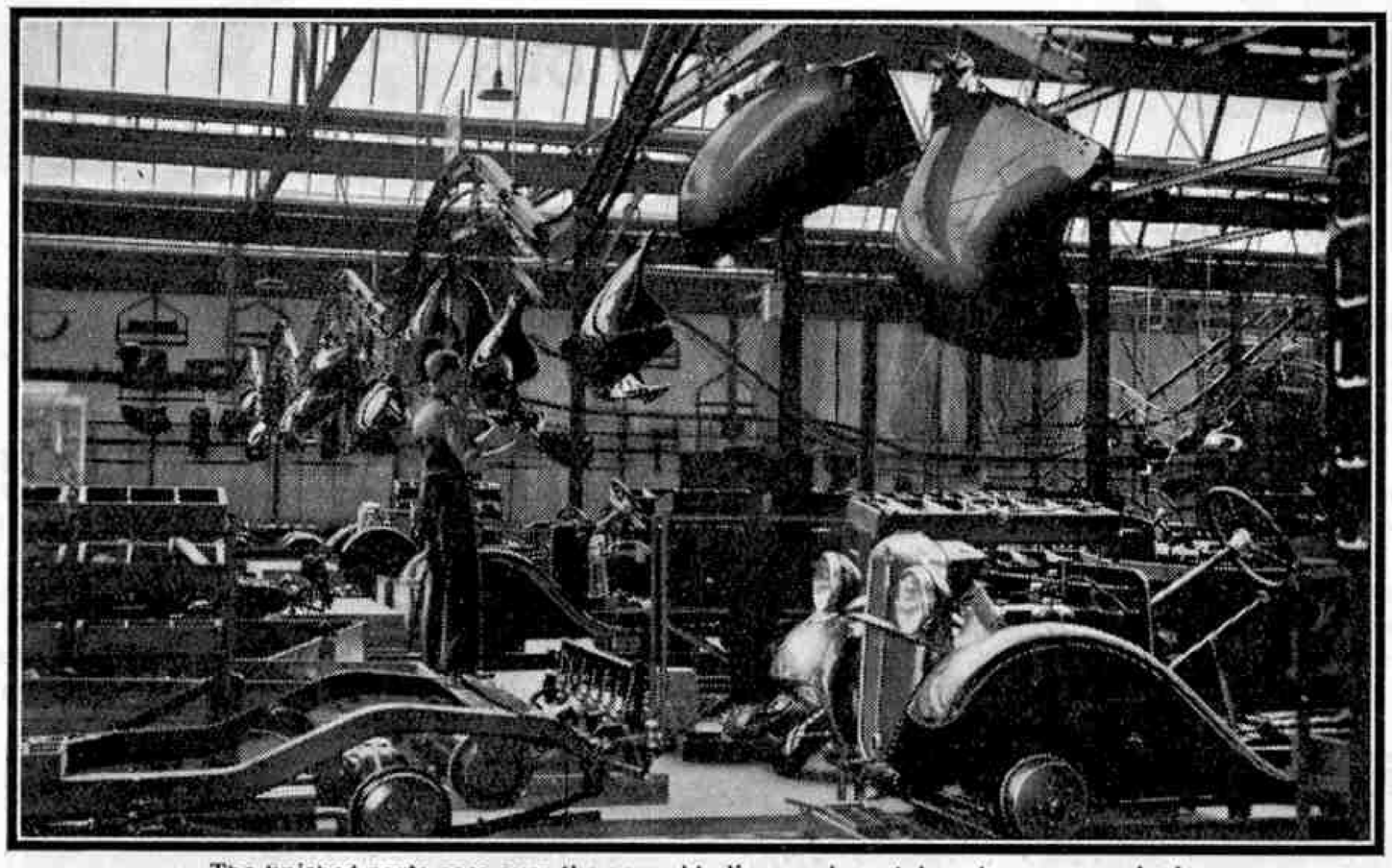
In the meantime the smaller components, delivered at the loading dock ready for assembly, make their way from bins to the entrance to the main erecting shop by means of electrical conveyors. They are then transferred to trucks that are mated with a chain conveyor, ratchetted on the lines of funicular railways. The difference is that in the case of the latter the ratchets are stationary and prevent the train from running backward, while in the case of the chain conveyor, they act as the motive power for the trucks. Actually, an abutment on the conveyor chain engages a roller on the truck to propel the units along. The conveyor runs both ways, one into the erecting shop, and the other to return the empty trucks.

In the main erecting shop this conveyor travels to an overhead platform and has a number of junctions and branch lines leading to five wells above the respective chassis erecting lines. Two operators stand on the platform to control the feeding of the trucks by overhead trolleys to the correct lines and to pass the empty trucks to the return conveyor.

In the erecting shop there are five main assembly lines, the distributing platform over the lines fed from the sub-assembly shop, another platform for distributing axles and engine units, and an enamelling plant running the whole length of the shop at one side. Chassis frames are delivered into the frame storage section, pass on to

the drillers, and thence under the axle platform, to the commencement of the chassis erecting lines. Engine units are received at this end of the shop, placed in racks, and taken to the overhead platform as required.

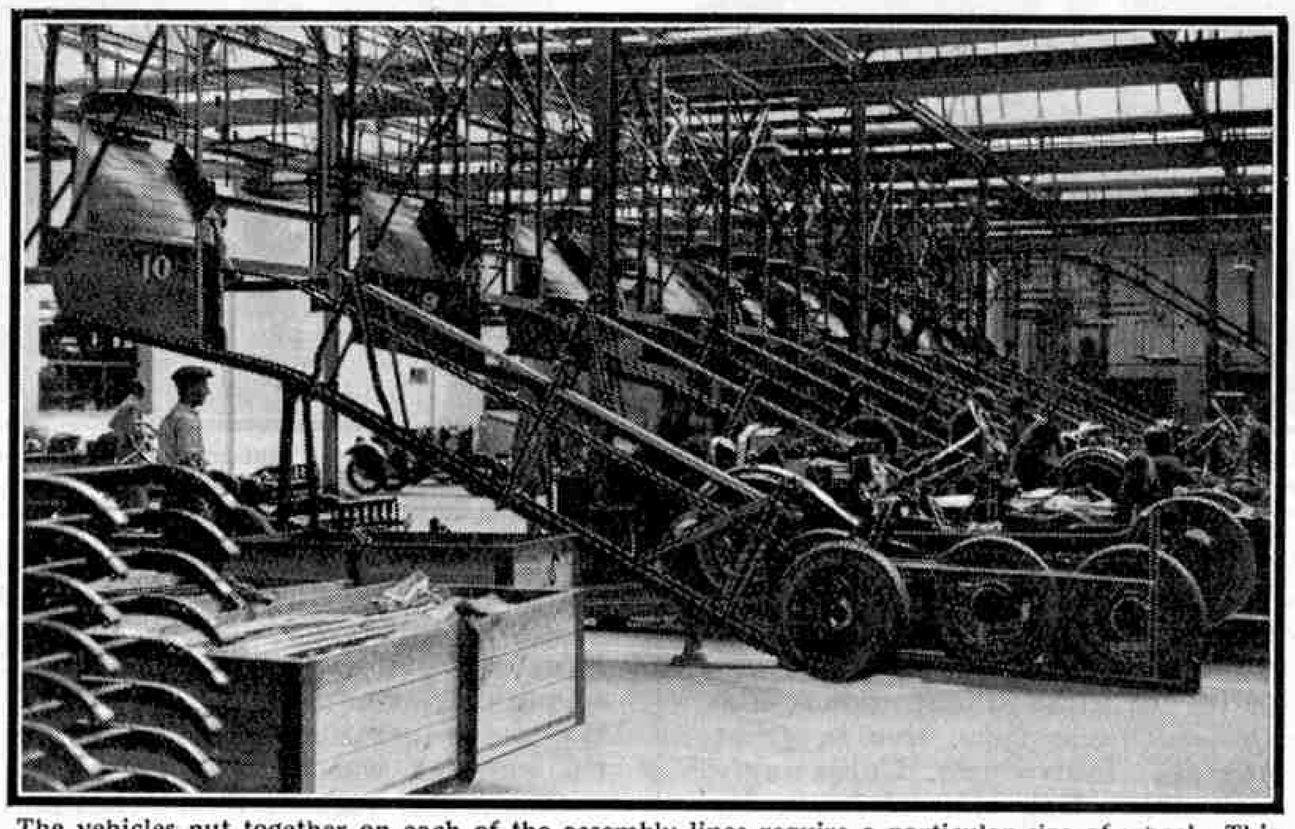
We must digress a little to examine the enamelling plant for wings, wheels, luggage grids, etc. A conveyor system operates here. All parts to be enamelled are placed on the conveyor, which takes them slowly through a tank containing caustic soda solution to remove all traces of grease, and thence to another tank containing hot soda. The parts are then spray rinsed and pass through a tunnel maintained at a temperature of 200 deg. F. for drying and burning off any residue. The conveyor then travels through a series of enamel baths—which contain a total of 60,000 gallons of black enamel—and drying ovens. Finished parts are placed on further conveyors that travel out into the erecting shop and over the chassis lines, as seen in the upper illustration on this page.



The finished parts pass over the assembly lines and are taken down as required.

Having dealt with the various subsidiary feeds to the erecting lines, we can now follow the growth of the chassis.

Each erecting line is a moving conveyor, the speed of which can be regulated. The chassis frame is placed at the commencement of the line and begins its journey. Passing underneath the first platform, axles are lowered through wells on to the frame. Continuing its journey, the engine is similarly delivered. Other parts are stored alongside the lines, and are supplied in truckloads by an overhead trolley running alongside each line from the second platform. Minor components and radiators are added until the chassis is ready to enter the spray painting booth situated under the second platform. It then passes through a drying oven, and on emerging is supplied with measured quantities of oil to all parts. Proceeding to the end of the line, growing constantly, it reaches its last stage, the fitting of the wheels and tyres.

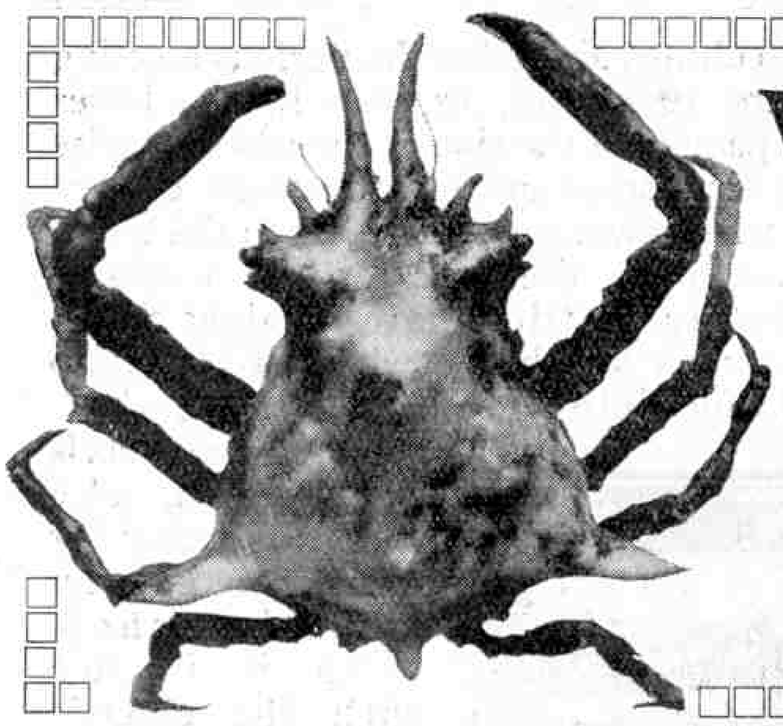


The vehicles put together on each of the assembly lines require a particular size of wheel. This photograph shows the wheels and tyres being automatically delivered to the correct lines.

Here a most ingenious device is in use. Adjoining the end of the enamelling plant is a section for the storage of wheels, and equipment for fitting tyres and inflating automatically. When complete, they are placed on a conveyor and fed to chutes alongside the various erecting lines. But there are 10 chutes, as seen in the lower illustration on this page, and the size of the wheels varies with each line, so that some system to ensure correct distribution of the wheels was necessary. When the wheel is placed on the conveyor, the operator sets a master switch so that in its travel it trips above the right chute, causing the platform on which the wheel is placed to tilt, and the wheel slides into its respective chute.

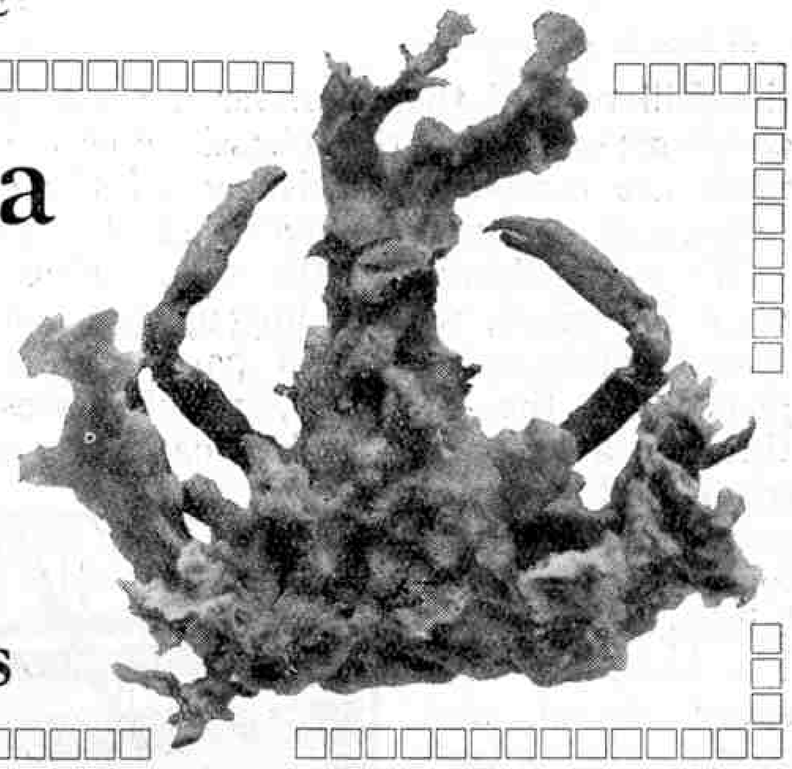
When the wheels are fitted, the chassis is ready for transfer to the body mounting shop, which is in line with the chassis erecting shop. The bodies, which have been rubbed down, prime painted, cellulosed and trimmed, all while travelling on conveyor systems, are then placed on another conveyor that runs parallel with the finished chassis track, passing along to the end of the line. An overhead crane picks up each body as it comes within its range, and places it on its respective chassis. The complete unit is then transferred to another conveyor travelling in the same direction, the body mounting and bonnet fitting is completed, and when the car passes off the end of the track it is ready for road testing.

In all, there are 10 miles of mechanical conveyors in the Morris Cowley works. All processes are designed to follow in logical sequence, enabling the workmen to concentrate on their tasks as the work is brought to them automatically; and at each stage of the growth of the car the assembly is subjected to the most stringent tests to ensure accuracy. Tests are not, however, confined to the assembly stages, and many are applied before materials are allowed to enter the factory. In the laboratory instruments test in 64 hours the effects of a year's normal weather on fabrics, wood undergoes moisture tests, and fabrics are tested for tensile strength and ability to resist wear. One of the most interesting of these tests is that in which specimens of wood are isolated with fungi to ascertain the effects of malignant growths. If the wood under test rots it cannot be used in Morris coachwork. The fungus that is employed in these remarkable tests would die if it were not fed, and Morris chemists therefore keep it alive by feeding it with malt extract.



Wonders of a Coral Sea-Garden

Some Curious Animal Partnerships



EVERYWHERE in the shallow stratum in which the life of this planet finds suitable conditions it has expressed itself with astonishing exuberance and variety, but nowhere is the prodigality of its wealth more in evidence than among the reefs and shoals of the Tortugas Islands, that group in the Gulf of Mexico which marks, south and west, the extreme limit of the Florida Keys.

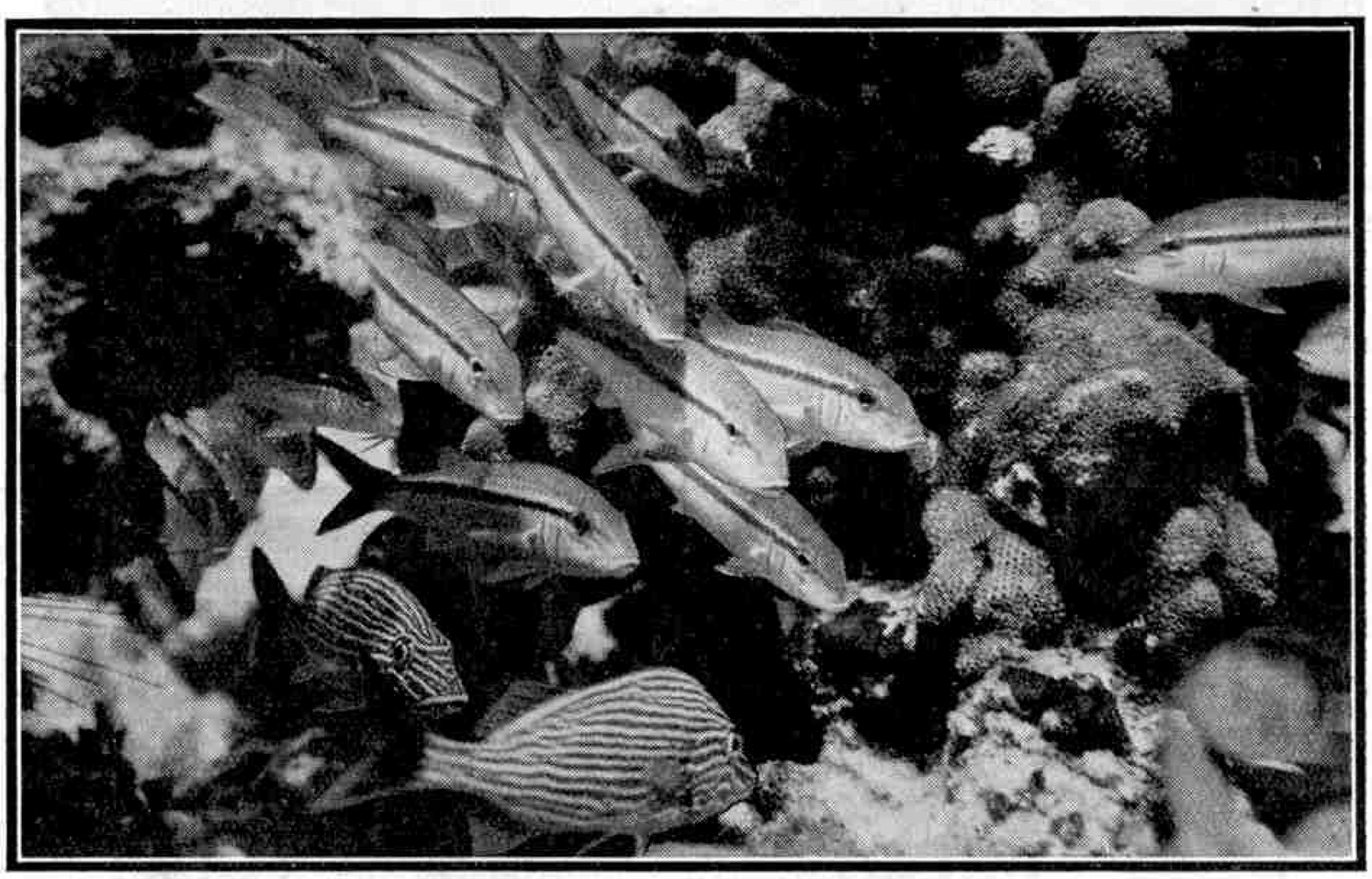
The land surface of the eight "keys" (*cayo*, the Spanish for "island") composing the group is a scant quarter square mile. Their appearance upon approach is not imposing, for the first faint flashes of reflected light one catches from them are so like those from the encompassing sea as scarcely to be distinguishable. Upon nearer advance these islands are seen to be but bars of coral sand, covered only with vines, coarse grasses and small shrubbery, and lying so low as barely to jut above surface at full tide.

Although the Tortugas are inconspicuous above water, nevertheless that part which is beneath the sea is of impressive extent. Indeed, were the sea-bottom thereabouts elevated twenty feet, twenty square miles of land would emerge, the existing islands would increase greatly in area, and several members of the group lost within a century would reappear. These new islands, together with the old, would form an imposing atoll, ten miles long and five wide, with three chief ship channels and several lesser watercourses connecting the lagoon with the open sea.

During geologic ages the sea-bottom near these islands as well as the under-water slopes have been blanketed by coral polyps that have the property of forming around and beneath themselves a thick protecting skeleton of lime. These flower-like animals, most of them of the sea-anemone type, live in great colonies that comprise myriads of individuals. Unceasingly these fixed organisms are at work converting the calcium salts in solution in the sea water into what in the mass becomes hard calcareous rock. Thus, by this slow but enduring process, not only have the Tortugas Islands developed, but likewise thousands of islands and reefs elsewhere in the tropical seas.

The diversity among the skeletal remains of these coral and coral-like growths is astonishing. Some, such as the "organ-pipe coral" of the Indo-Pacific, consist of a mass of parallel cylindrical tubes, united at intervals only, by horizontal plates. In some, like "brain coral," the skeletal support resembles the convolutions of a human brain so closely that one might, at first glance, easily mistake it for a brain that had petrified. Others grow into flat paper-thin, radially arranged discs that look like the gills on the under surface of a toadstool. Still others, like the "staghorn" corals and the red ornamental corals of the market, are wide-branching, tree-like structures. Moreover, the coral polyps themselves and their cousins the anemones are of every conceivable colour—brown, violet, pink, white, yellow, purple, bright blue, vivid scarlet.

To don diver's helmet and descend to the fairy-land that lies beneath the crystal-clear waters of Tortugas is to enter a strange, new world of fantastic beauty and absorbing interest. If one is fortunate he comes to bottom in an open space covered with clean, white coral sand plentifully sprinkled with shells of creatures no longer living. In such case, a few paces usually brings him to a tangle of coral growths, whereupon he can choose an opening that gives promise of comfortable entrance and of easy retreat in case the going should become too difficult.



An undersea picture taken at Tortugas. The photographs in the heading show a crab that conceals itself beneath a protective covering of sponge, as its natural enemies avoid sponges. On the left the crab is seen without its protective covering, and on the right with it. Illustrations by courtesy of the Carnegie Institution of Washington.

Presently he finds himself in a passage-way between great coral heads, thickly studded with blossom-like animals of curious shapes and variegated colours, rising high above. From this vantage ground, as in a theatre, one can leisurely and unobtrusively watch the drama of life unfold as it is played by the actors on this submarine stage.

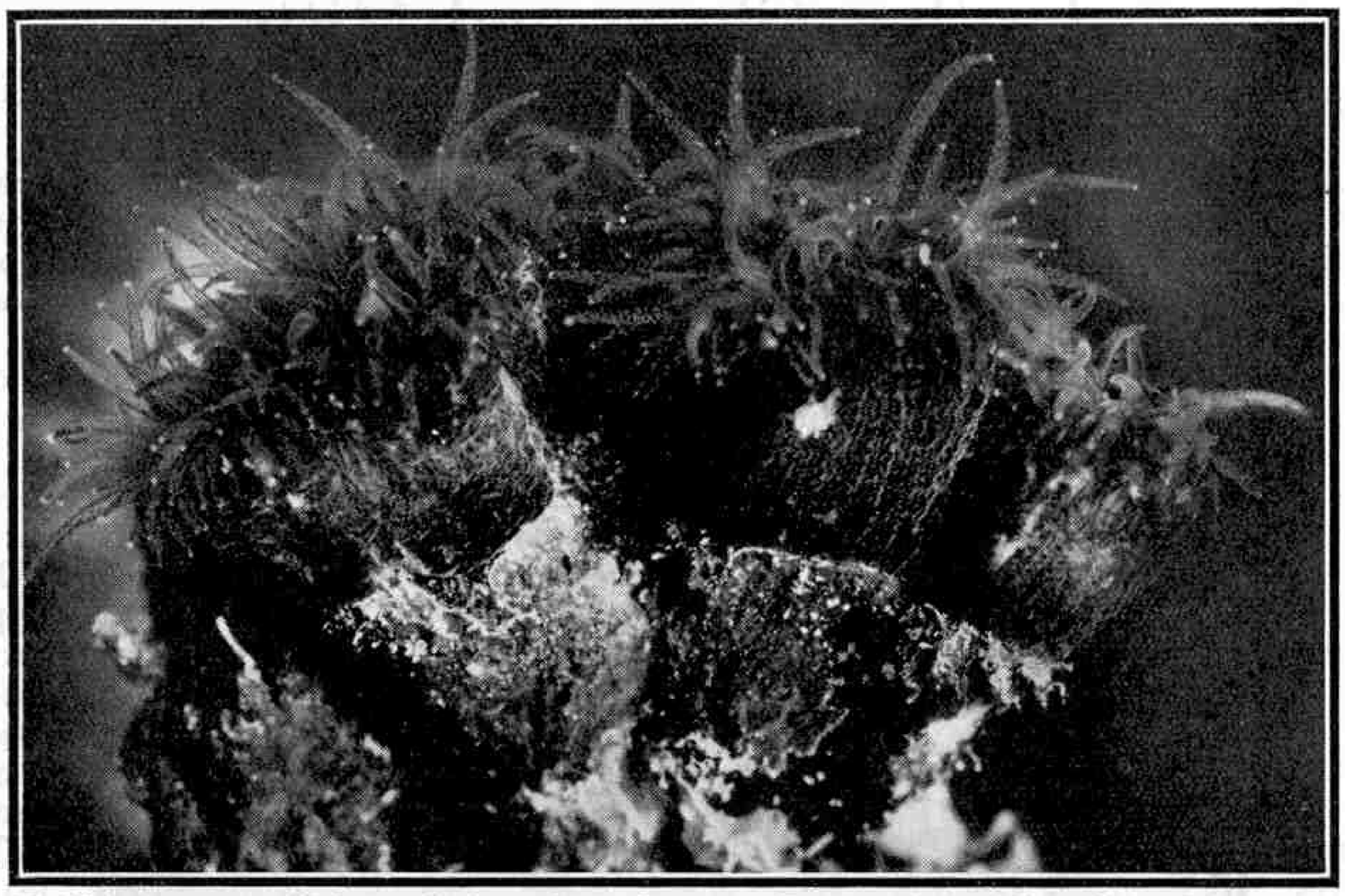
Quickly, however, comes the realisation that what he is witnessing is no play-acting—as he watches the tentacles of an octopus creep stealthily out from beneath an overhanging ledge and seize an unwary prey—as he sees a four-foot barracuda, the so-called "tiger of the sea," with one lightning dart and a single quick snap of powerful jaws cut a silver snapper in two—as he recognises that even the stalks, the branches and the "blossoms" of the plant-like structures swaying about him in such profusion are in reality but so many clever devices for catching, devouring and assimilating the living organisms wafted within their reach by currents of the ambient water.

Comes the realisation also that here amid these coral formations, bathed as they are with the warm, food-laden waters of the Gulf Stream, countless creatures have found a habitat to their liking, and that existence for them is a struggle to find and maintain position in it. In such struggle it is not to be thought that the rule of the jungle—"kill or be killed"—alone prevails for, indeed, many behave as though they had learned that co-operation is to be preferred to competition. At any rate, partnerships of the most extraordinary kind have developed among widely different types of organisms. While some of these partnerships are frankly destructive of one or the other of the members, as in the case of a parasite and its host, others are beneficial to one, apparently without harming the other; while, in still other cases the relationship is helpful to both.

The Greeks had a word, *symbiosis*, meaning, "a living together"

and the Latins a word, *commensal*, meaning, "one who eats at the same table." These expressive terms have been borrowed by scientists and applied to dissimilar organisms that live together in more or less intimate and beneficial association, of which there are many striking examples at Tortugas and elsewhere among the coral islands of the tropical seas.

Coral polyps themselves present a case in point for they live in partnership with a plant, a single-celled green alga, which swarms in their tissues, often giving them a greenish colour, so abundant is it. Like all green plants these algæ possess the power of extracting essential chemical elements from the environment and, through action of sunlight, of transforming these elements into starch which, in turn, is converted into sugar by the coral polyps and used as food.

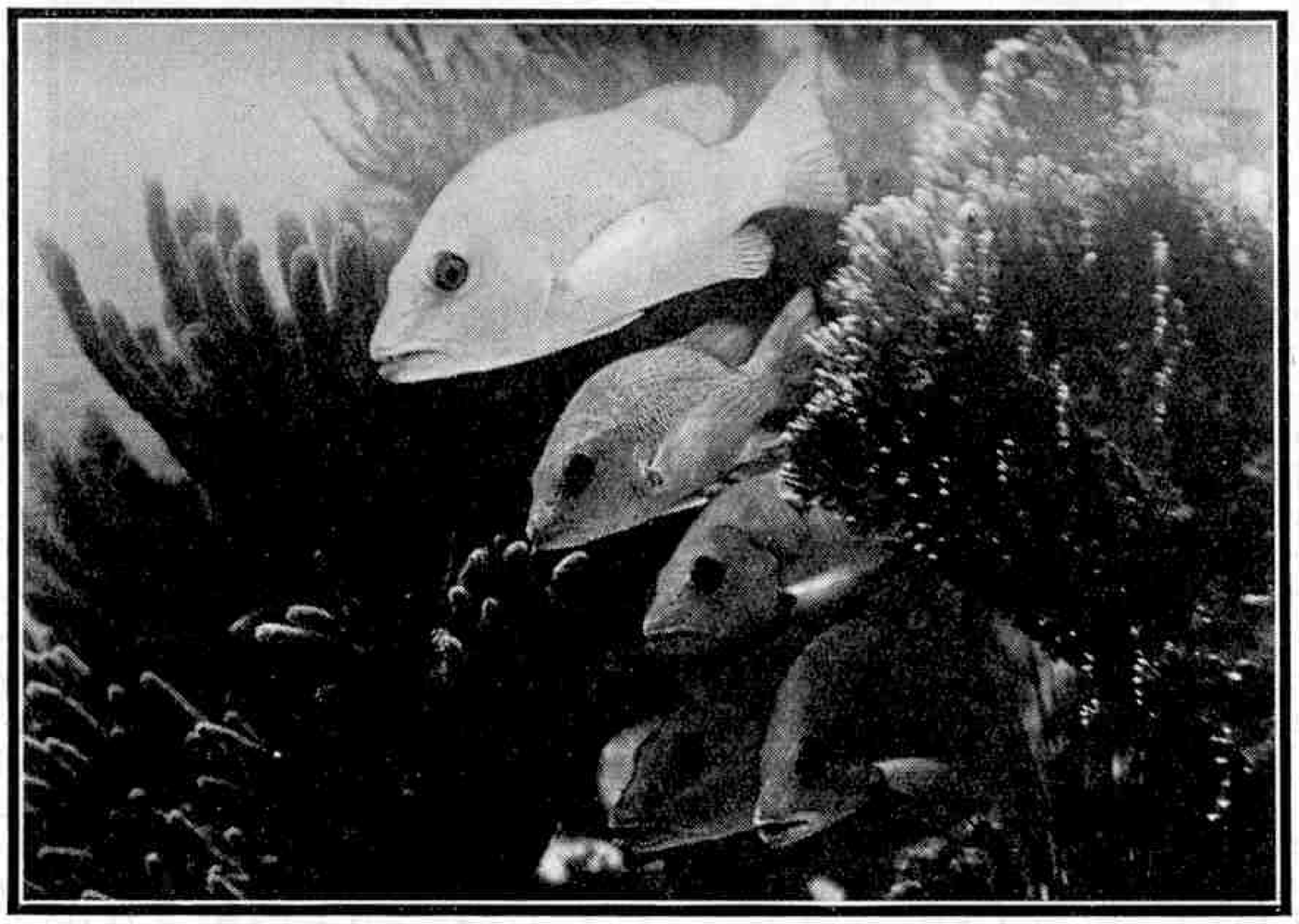


Flashlight photograph of living coral polyps, taken under water at Tortugas. Note the fringe of tentacles at the top.

While not all corals are dependent for food upon such association, many species are, in part, and a few entirely. This factor has an important bearing upon the distribution of corals, for all those that rely upon plants must live in water shallow enough for the latter to obtain the full measure of light that they require; indeed, reef-building corals are rarely found below a depth of 150 feet. The plants, on the other hand, benefit from association with their hosts, for they obtain shelter from them and, more especially, the chemical elements, carbon dioxide and nitrogen, that they need.

Dr. W. H. Longley, in charge of the marine biological station that Carnegie Institution of Washington maintains at Tortugas, and who has made a special study of the life habits of the creatures that inhabit coral reefs, tells of many such singular partnerships.

One of the most interesting examples is *Lybia* [*Melia*], a coral reef crab of the Pacific. This crab deliberately removes certain anemones from the rocks to which the latter adhere, and carries them fully expanded in its first or clawed pair of legs. When it is attacked it defends itself by pushing these anemones toward the assailant; as the anemones, in turn, capture food the crab takes it, or part of it at least, and transfers it to its own mouth. Inasmuch as the anemones have so many more opportunities for obtaining food by being moved about they can well afford to share their catches with their partners.



Another fascinating underwater photograph, showing grey snappers in their picturesque surroundings.

Longley also tells of crabs that deliberately tear bits of living sponge off the rocks and hold them on their own shells until the sponges take root, so to say, and begin to grow. Thereby the crabs secure effective protection from their enemies, for the species of sponge they thus utilise is distasteful to many creatures as it is packed with flinty, needlelike bodies and, besides, gives off a very disagreeable odour.

Then there is a vividly coloured fish, about an inch and a half long, that is always hovering about the giant sea-anemone. Upon the slightest alarm it darts for the anemone "blossom" and disappears among its feathery tentacles. When danger passes the finny occupant emerges from its protective cover. It is said that this fish is so dependent upon the anemone that it dies if the two are permanently separated.

Other creatures common at Tortugas, such as the sucker-fishes, attach themselves to larger fishes. The most notable of the group, the *Remora*, bears on its head a sucking disc that is a modified backfin, looking much like the corrugated rubber heels of shoes. This fish is frequently found clinging to sharks, to which it affixes itself in order, apparently, to obtain a free ride to the spot where a kill is made. Upon arriving it detaches itself from its host and feeds upon the fragments. So powerful is the suction of the disc of the *Remora* that the natives of Chinese waters use the fish for catching turtles. Attaching a thin line to its tail, they cast it into the water near a turtle, towards which it promptly darts, fastening itself quickly to the under surface. If the turtle is not too heavy and powerful it can thereupon be drawn to the boat and firmly secured.

Perhaps an idea of the extent to which the practice of symbiosis and commensalism is carried by these marine creatures can best be conveyed by referring to the results of a study of the occupants of sponges, made by Dr. A. S. Pearse of Duke University who spent the summer of 1931 at the Carnegie Institution Marine Biological Station at Tortugas where he made the investigation.

Pearse removed a "loggerhead" sponge, which was about the size of a large washtub, and placed its base in a container so that no animals would be lost. He thereupon sliced the sponge into thin sections, as one would slice a loaf of bread. Each slice was carefully examined and the animals picked out, placed in bowls, and counted under a reading glass of considerable magnifying power. When the count was completed, Pearse learned that this particular living hotel was housing 17,128 guests, which meant that there were approximately two animals to every cubic inch of its volume.

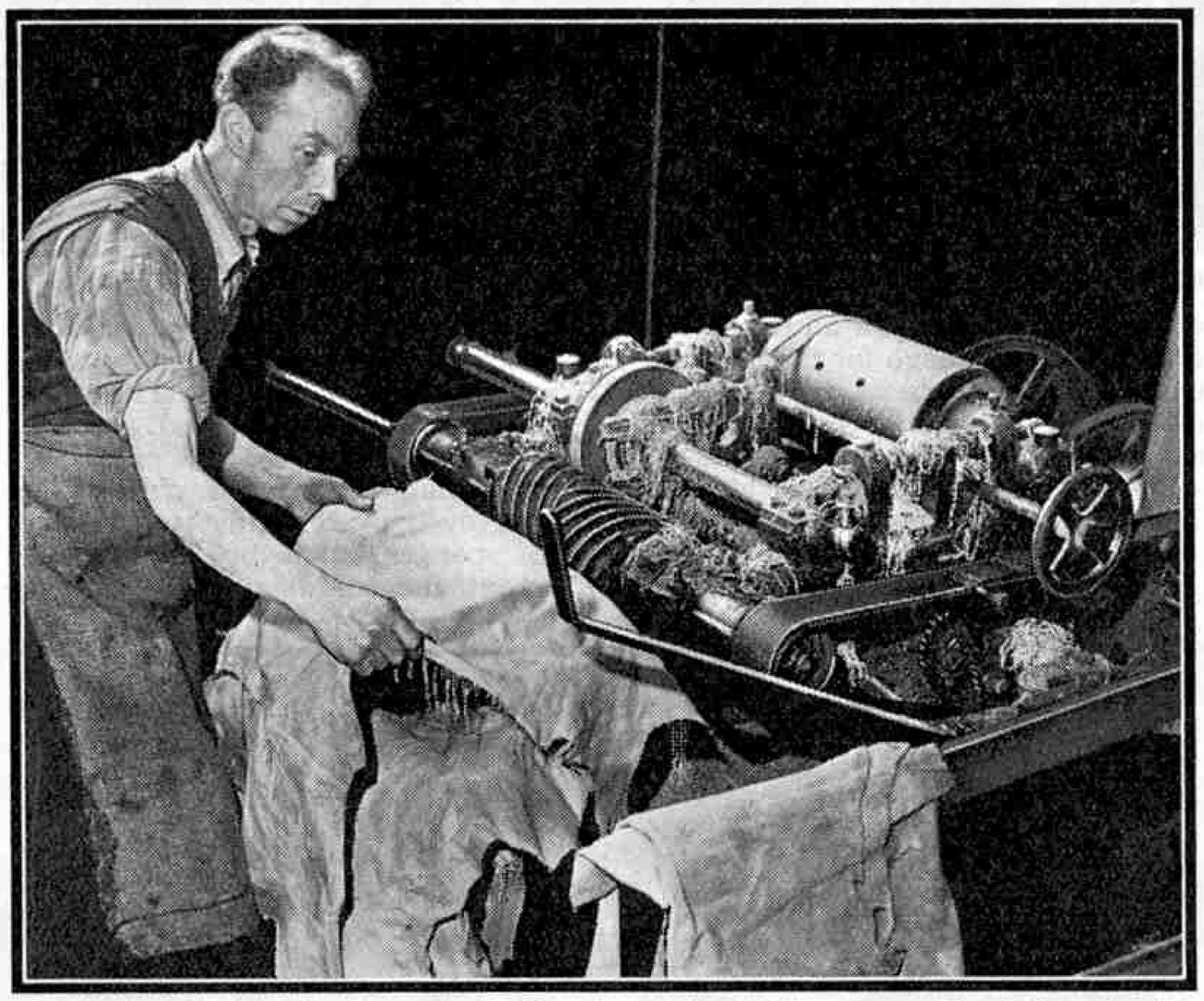
Among this great host of creatures were five fishes of the genus *Evermannichthys*, each about an inch in length, having exceedingly slender bodies, well adapted to life in the canals of the sponge. Members of this genus are regular inhabitants of sponges, never having been found elsewhere. Annelid worms, numbering 229, were taken from the canals and, embedded in the tissues of the sponge, 38 barnacles were counted which, however, were in direct connection with the sea through surface holes.

We are indebted to the courtesy of the Carnegie Institution of Washington for the information in this article.

How Things Are Made

Leather Gloves and Mitts

GLOVES have been used for thousands of years. Crude examples have been found in prehistoric cave dwellings and Egyptian tombs, and there is also a reference to gloves in the Odyssey. We know that some sort of protective coverings for the hands were used by the Greeks and Romans in certain kinds of manual labour, although their precise form is unknown. Gloves did not come into general use in England until the 13th century, but a hundred years later they were a common article of dress among the richer classes, and they were frequently embroidered very elaborately. In those days gloves played a very important symbolic part in the lives of the people, for the throwing down of a glove was the recognised form of challenge to a duel, while in the East the transfer of a glove from seller to purchaser sealed the sale of property. The manufacture of gloves was introduced into the British Isles at an early date, and by 1464 the craft had achieved such dignity and importance that the Glovers' Company of London received armorial bearings, although it was not chartered until 1638.



An operator shaving skins in preparation for glove making. When the machine is in action the rotary knife revolves very rapidly and is protected by a guard. Photographs to this article by courtesy of James Hanlon and Son Ltd., Liverpool.

Nowadays gloves have lost their romantic associations of earlier times, but the processes by which a pair of gloves is manufactured in an up-to-date factory provide much to interest all who like to know how the things they use in their daily lives are made.

There are many kinds of modern gloves, leather, lisle, silk, and woollen, etc., and in this article we shall describe some of the many interesting processes carried out in the manufacture of leather gloves at the Rose Leather Factory of James Hanlon and Son Ltd., Liverpool.

Some of the skins used at this factory arrive already tanned, while others are bought in the pickled state, that is with the wool taken off, and preserved in a mixture of sulphuric acid and salt. Before the skins can be worked into finished goods it is necessary to carry out various dressing processes in order to improve the appearance and character of the leather. These processes vary according to the purpose for which the leather is required.

The skins of deer, East Indian sheep, lambs, goats and kids are used for glove making, but the name of the glove is not always that of the animal from which it came. French kid probably is the finest glove material, but the majority of so-called kid gloves are made from lamb or deer skins. English "doe-skin" or "Cape" gloves were originally made from the skins of sheep grown at the Cape of Good Hope. "Mocha" gloves are made from Arabian sheep-skins, which were first shipped from the port of Mocha.

An amazing amount of work is required in the making of gloves, quite apart from the actual tanning or conversion of the raw skins into leather; and in order to appreciate properly the processes involved it is best to start right at the beginning and follow the various stages of tanning.

The manufacture of leather probably was one of the earliest arts practised by mankind. Originally the process consisted in rubbing the fat of the animal on the raw skin, and kneading and stretching it in a warm place until a soft and durable leather was obtained. Similar methods, in which butter, egg-yolk, brains, oils, etc., are used are practised at the present time by the Tartars and North American Indians. Modern tanning processes, however, are very complicated, and in the following description we have been able to deal only in a general manner with the most important stages in the conversion of raw skins into leather.

First it is necessary to remove the hair and dirt from the skins. If the skins are uncured (green), they are soaked in water for a few hours to restore their soft and natural condition and to remove any adhering blood and dirt. Removal of the hair may be effected in two different ways, the more usual of which is to place the skins in pits containing milk of lime. Each day they are hauled out of the pits and then put back again so as to ensure uniform action of the liquid, the time of treatment varying according to the nature of the skin and the type of leather required. Certain chemicals are sometimes added to the milk of lime to hasten the process of unhairing and to produce special kinds of leathers. After soaking in the lime pits the hair is removed by scraping with a blunt two-handled knife. Sheep skins may be unhaired by painting the flesh side of the skin with a mixture of slaked lime and sodium sulphide made

up in the form of a paste. After a few hours this mixture loosens the wool sufficiently to enable it to be pulled out by hand in an undamaged state. Before the unhaired skins are actually converted into leather the lime contained in them is completely removed.

The actual tanning is effected by tannin, a substance obtained from various vegetable products, such as oak-bark (which is one of the oldest tanning materials), sumach, cutch, gambier, myrobalans, chestnut extract, valonia, etc. The extract of these materials with water has the property of combining with the gelatinous fibres of the skin to form the insoluble and stable product leather, which remains soft and flexible on drying. Owing to the impervious nature of the skin, the complete penetration of the tan-liquor takes a considerable time, varying with the thickness of the skin and the strength of the liquor. The tanned skins are washed in water, dried, smoothed, and compressed by mechanical means, and are then ready for use.

A view of the sewing room where the separate pieces of leather are sewn together by power driven machines.

Some kinds of gloves, such as those used by workmen handling hot tools, as in the foundries and gasworks, etc., are made from chrome leather. Chrome-tanned leathers are made by placing the skins in a rotating drum containing a solution of chrome alum or of chromium sulphate, rendered slightly basic with soda. They remain in the drums for several hours and when removed are allowed to lie in piles for some days. They are then washed and treated with a weak solution of borax or some other mild alkali to remove all traces of acidity. The skins are finally treated with a "fat-liquor" (an emulsion of soap and oil) which lubricates the fibres of the leather and improves its quality.

Chrome tanning may be carried out also by steeping the skins in a slightly acid solution of potassium or sodium bichromate, and then transferring them into a solution of sodium thiosulphate, the photographers' "hypo."

Cutting out glove parts on a power stamping machine. The peculiar knives or webbs used on the machine can be seen in the lower left-hand corner of the illustration.

As already mentioned, some of the skins arrive at the glove factory tanned and ready for the finishing or dressing processes. In this case the tanned skins are first of all shaved. This is done by a machine that is very similar to a joiner's planing machine. It has a cylindrical steel knife of peculiar pattern, which revolves at a very high speed, and this shaves off all the projecting fibres on the skin and gives it a uniform smooth surface of even thickness. If the skins are to be chromed or semi-chromed, they next pass to the chroming drums, and after this they are placed in large rotating dyeing drums, where they are stained to the required colour.

"Striking out" is the next operation, and it consists in passing the wet skins between powerful rollers, which carry them into contact with a rapidly revolving drum that has projecting blunt-edged knives in the form of a thread throughout its entire length. One half of the "thread" is left-handed and the other half right-handed, and the drum is made to revolve at a very rapid rate, the blunt edges of the knives striking the surface of the leather as the drum rotates. By this action the grain of the leather is struck out, and the leather is smoothed and stretched in a very rapid and efficient manner.

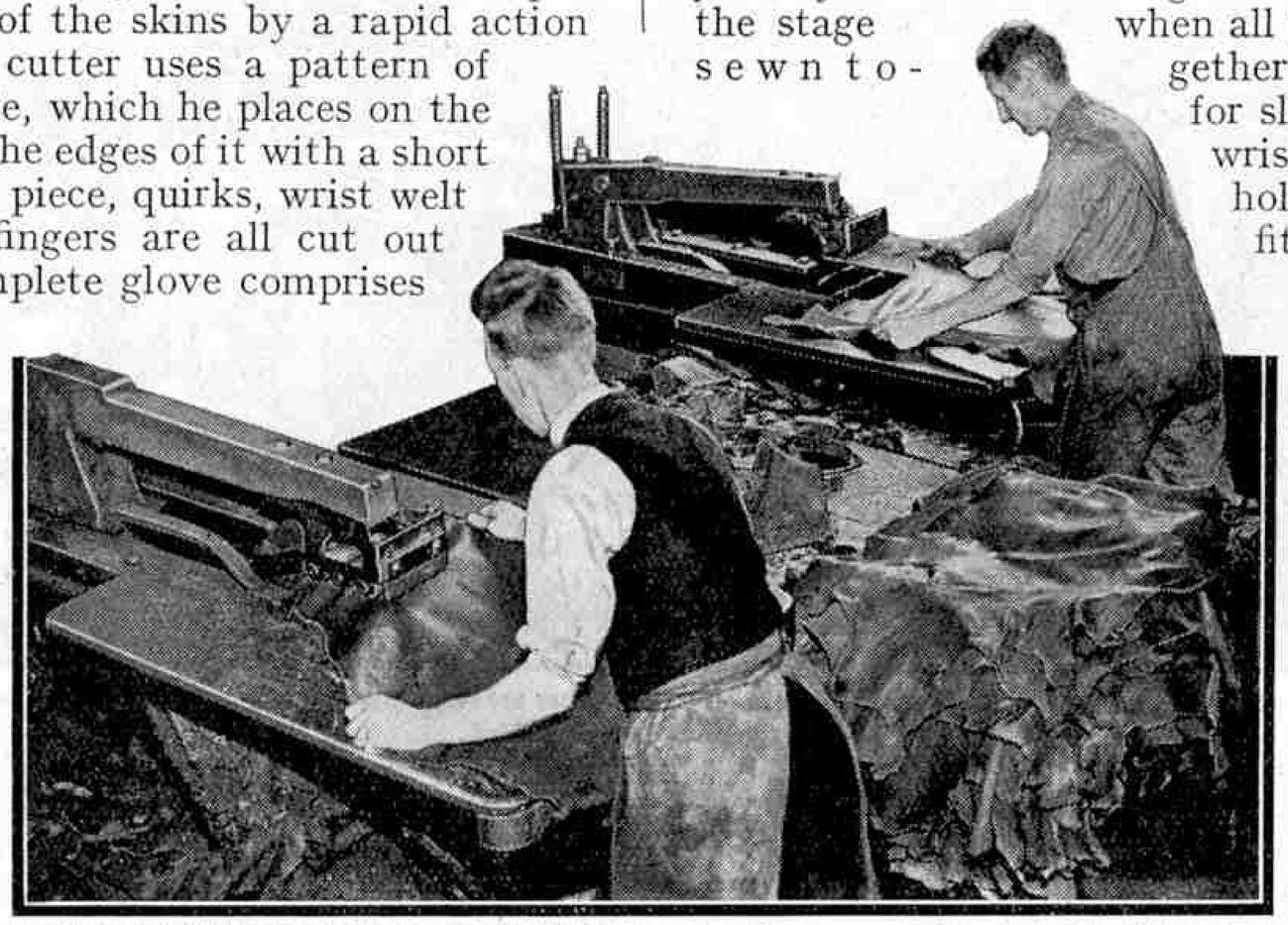
After striking out, the skins are dried, and then they pass to what is known as a "staking" machine. The essential part of this machine is a reciprocating arm, at the end of which are padded jaws that open and close as the arm carrying them moves to and fro. The reciprocating arm moves very quickly, and each time it advances an operator throws a skin between the open jaws and then holds the end of it securely against the front of the machine when the jaws close on it. As the arm moves backward, the padded jaws slide with considerable friction over the skin. This action is repeated until all parts of the skin have been worked, the object of the process being to bring up the grain and soften the leather. Afterwards the skin is sprayed with special dope to give it the required finish. Thorough drying and re-staking follow, and then the finished skins are passed through an ingenious measuring machine, which records the area of each skin on a dial. There are several other processes in skin dressing, and only the most important have been described here.

Now the actual glove making begins. The better class gloves, such as Cape and doe-skin, are first "tranked" out, that is, pieces of leather are cut out by hand a little larger than the size required for the gloves. These pieces

are stretched all ways until all the stretch is taken out. They are then placed together in piles of half-a-dozen, and cut out to the correct size and shape with peculiar steel knives known as "webbs," by a slow action power press.

Hand cutting is employed in the making of medium class and chauffeurs' driving gloves, and the cheaper kinds are cut direct out of the skins by a rapid action power cutter. The hand cutter uses a pattern of the required size and style, which he places on the skin while he cuts round the edges of it with a short curved knife. The thumb piece, quirks, wrist welt and the insides of the fingers are all cut out separately, so that a complete glove comprises quite a number of separate pieces of leather. The scrap pieces left over after the main portions of a glove have been cut from the skins are used in making the strips for the sides of the glove fingers, etc.

From the cutting room the embryo gloves are sent to the sewing room. There are many methods of sewing, fine gloves being sewn over and over, while heavy walking gloves may have one edge lapped over the other. Very heavy gloves, such as are used by manual workers, have the edges of the component pieces brought together and sewn through and through. There are hundreds of machines in the sewing room, and although at first sight they appear similar, close inspection reveals many important differences in their construction and the work that they do. One machine, for example, sews the thumb pieces into the palm, while another finishes the sides of the fingers. Other machines do "pointing," an interesting operation that consists in making rows of decorative stitches on the back of the gloves. The pointing machine has four needles placed in a row close together, and they work through a special type of feeder plate that crimps the leather between each row of stitches. At this stage, if the glove is for winter wear, fleece or fur linings are inserted.



A "striking out" operation in the course of skin dressing. The purpose of the operation is described in the accompanying article.

As each operation is completed the gloves continue their journey round the sewing room until finally they reach the stage when all the component pieces are sewn together and the gloves are ready for slitting and binding at the wrist, and to have the buttonhole or press button fastener fitted.

After these operations have been carried out the gloves are sent to the finishing department. Here each glove is placed on a moderately heated iron stretcher, shaped roughly like a flat hand with flat fingers. The heat dries and sets the leather so that the gloves retain their shape after removal from the stretcher. A little paper tab on which is printed the size is then stuck inside the wrist of each glove, and the finished gloves are banded together and packed in cardboard boxes ready for despatch.

In addition to ordinary wool and fur lined dress gloves, James Hanlon and Son Ltd., manufacture all kinds of mitts and gauntlets for industrial purposes. Some of these are made from heat resisting leathers and are faced with asbestos. Gloves of this kind are used by workmen who have to work in contact with heat, and they are so effective that with them a man can handle a red-hot bar without hurt. Other goods made at the Liverpool factory include footballs.

Shipping Giant Locos—(*Continued from page 135*) is a typical example of these special-purpose ships, and made her first voyage in July, 1924.

This vessel has a total deadweight carrying capacity of 3,440 tons, which includes stores, fuel, water and spare gear. Her draught is 18 ft. 8½ in., overall length 303 ft., breadth 45 ft. and depth 21 ft. 6 in. She has a single deck with poop, bridge and forecastle, and is constructed on the transverse system of framing, with upright stem, elliptical stern, and deep bulwarks. She is fitted with a flat plate keel, and bilge keels run for about half her length amidships. Oil, fuel, and water ballast are carried in the double bottom, and other water ballast tanks are provided in the space between the upper and the bridge decks, and in the large forward and aft peaks. There are two cargo holds, each served by a large hatchway, and specially arranged to be clear of obstruction. Six 3-ton derricks, each operated by a steam winch, are so arranged that the cargo is discharged with the minimum of delay.

The "*Beldis*" is propelled by a single-screw Armstrong-Sulzer Diesel engine of the inverted four-cylinder type, situated aft and capable of developing 1,350 h.p. continuously. It is direct-acting, and works on the two-cycle principle with port scavenging, the latter being effected through ports arranged circumferentially in the cylinders opposite the exhaust ports. The upper row of ports is controlled by means of multiple-ring valves, so arranged that they open after the pressure of the exhaust gases in the cylinders has reached its lowest point. They do not close until after the piston, on its upward stroke, has entirely covered the exhaust ports, whereby it is possible to deliver a surplus charge of fresh air into the cylinders.

The engine is fitted with a double-acting air pump, and there is a three-stage air compressor, driven by cranks and connecting rods from an extension on the main shaft.

In cases where it has been necessary to transport locomotives by road from the makers to a port for shipment, the remarkable articulated lorry of M.R.S. Ltd., the well-known firm of road transport contractors, has frequently been used. This was described in the "*M.M.*" for May, 1932, and is capable of carrying a load of 100 tons on its 14 wheels.

It is interesting that many years ago road transport of locomotives by means of horses was regularly carried out, of necessity, by the long-defunct firm of G. England & Co., of London, as there was no railway line in their Hatcham Works.

Locomotive Fire-box—(*Continued from page 159*) this country has been confined to experiments only, first on the former G.C.R. in 1920, and more recently on the Southern Railway. Experiments were also made on the G.C.R. at the same time with what was termed "colloidal" fuel, a mixture of pulverised coal and oil. In America many locomotives are fitted for burning pulverised coal; and in Germany successful experiments have been made with the native brown coal, or "lignite," in pulverised form.

The use of oil fuel is common in regions or countries where supplies are easily available, but in this country in recent times it has been applied only as an emergency measure, when coal supplies have been interrupted owing to strikes. It is interesting, however, that about 30 years ago the former G.E.R. had in operation a very successful system of oil burning devised by their then Locomotive Superintendent, Mr. J. Holden.

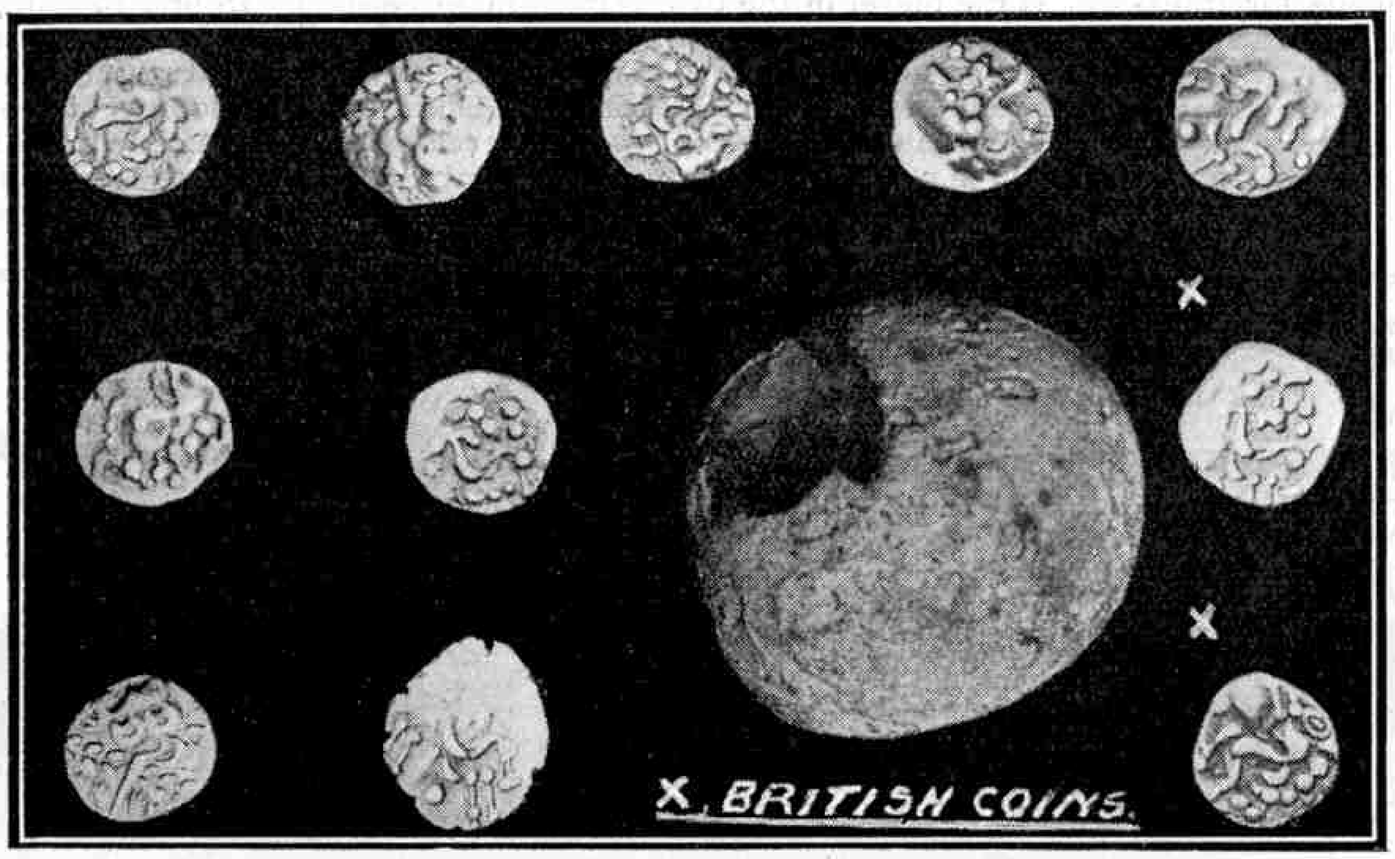
Within its limits the scheme was satisfactory and economical. As a result of the expansion of the system, however, it became no longer an economic proposition, owing to the rise in the price of oil. Among the G.E.R. engines fitted with the Holden apparatus were No. 760, specially named "*Petrolea*," and many 4–4–0 locomotives of the "Claud Hamilton" class.

The Oldest Money Box in Great Britain

A Flint Purse of 2,200 Years Ago

By W. Coles Finch, M.I.C.E.

ARCHÆOLOGISTS divide the period that may be described roughly as extending from the first appearance of Man down to the beginning of the Christian Era into four great epochs. These are respectively the Palæolithic or First Stone Age; the Neolithic or Second Stone Age; the Bronze Age, and the Iron Age. The most characteristic feature of the Stone Ages is the use of flint instead of metal for making tools, implements and weapons. Flint is an extremely hard mineral consisting chiefly of silica that is found in chalk deposits. In the early Palæolithic Age, primitive Man found plentiful supplies of flint in the beds of gravel formed when the rivers began to groove out their present valleys leaving the flint behind them. Vast numbers of naturally formed flints were there ready to his hand, requiring little chipping to make them suitable for arrow-heads, axe-heads, knives and other weapons for the slaughter of the creatures that provided him with food and clothing, or for making implements to shape his boats out of the trunks of trees. It is a flint nodule of this period, turned up by the plough in a field near my home in Kent, that forms the subject of this article.



Coins of 2,200 years ago, and the crude flint money box in which they were found.

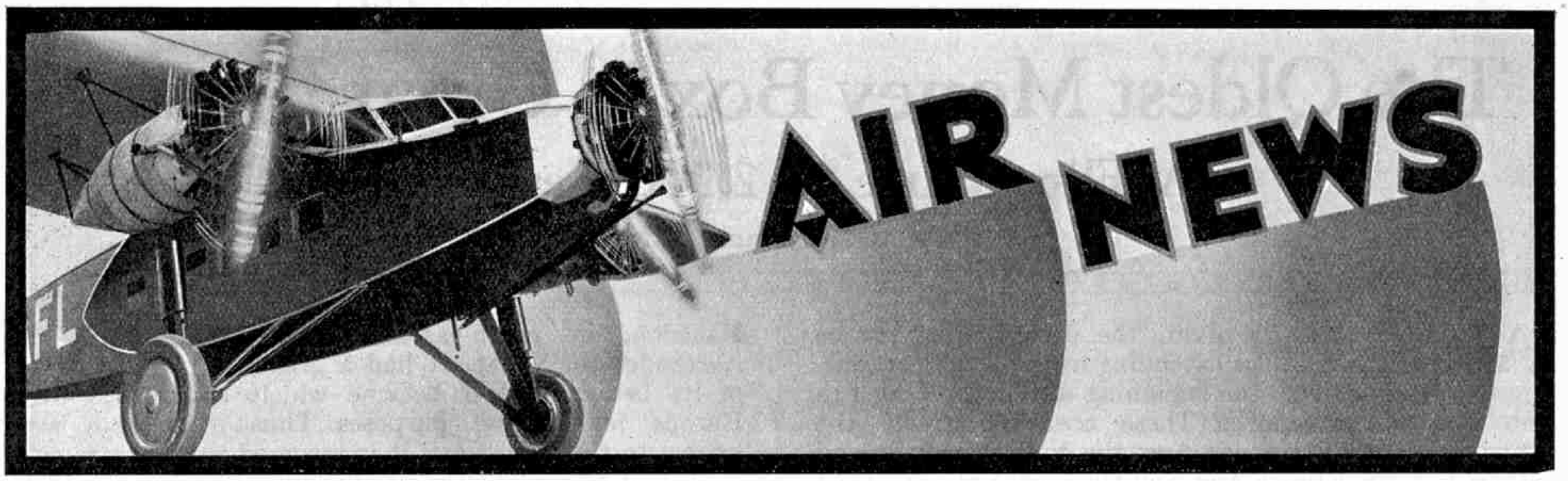
The flint nodule was turned up in 1912 in a field at Little Hermitage Farm, Higham, Kent. It was about the size of a duck's egg and it was one of my most interesting experiences to shake out of it 11 golden coins. The opening into the interior of the nodule was only just large enough to permit the coins, and thus what would appear to be merely a lump of flint with a hole in it was in reality the savings bank of one of our barbarian ancestors—the oldest money box in Britain! A safe deposit it had indeed proved, for not until at least 2,200 years had elapsed were the coins once more to pass from hand to hand. Through my instrumentality this purse is now the property of the Eastgate Museum, Rochester, where it may be seen.

The coins are slightly smaller than a sovereign, and at the time of their discovery they were described by an authority at the British Museum as being ancient Gaulish and Kentish barbarian copies of a famous Greek coin called the *Stater*, the standard gold coin of ancient Greece. This coin was originally issued between B.C. 359 and B.C. 336 by Philip II, King of Macedon, in north-eastern Greece, and father of Alexander the Great. It had a great vogue on account of its beauty and it became widely distributed over Europe for trading purposes. Thus it became well known to the Gauls, and it is assumed that they copied it in gold as well as they could and took some of their copies to Britain. The Britons in turn copied the Gaulish coin, and therefore the contents of the flint money box were copies of a Greek original. It is generally supposed that this British coin supports the theory that British gold coinage came into existence between B.C. 200 and B.C. 150, and that the rampant horse on it became heraldically the familiar symbol of our country.

Sir G. F. Hill, Director of the British Museum, who, when keeper of the Coins and Medals Department, also examined the coins, informed me that they are all of the same type and that on none of them is visible the exergue, or small space beneath the principal design for the insertion of the date. He added that the edge of the flan, the metal disc that received the impress of the die, in each case cuts off a portion of the horse's legs. This type is found both in France and England and is assigned to the Atrabates, an ancient Celtic people of Gallia Belgica, of which Arras was the capital. A branch of these people settled in England.

Whether all the coins were struck in this country is doubtful. Their weight suggests that they were probably struck in Gaul, but two of them which have a similar obverse are almost certainly British.

The discovery of these coins of some 2,000 years ago cannot fail to interest, but we must be prepared to think in millions of years if we turn an enquiring mind to the flint purse, and the geological viscissitudes through which it has passed. It began as silica in the waters of the ancient seas, where it was absorbed by sponges or other marine creatures that lived on the sea floor and was deposited in the form of a flint nodule, to take its place in the chalk formed by their shells. Its true native position is in the upper beds of the chalk formation. About two million years were required for the formation of these beds alone, and several times that period must have elapsed before this flint nodule found its way to the surface of our corn fields, to provide a safe deposit for our thrifty ancestor.



A Transatlantic Zeppelin Service

The new German Zeppelin, *"LZ129,"* which is approaching completion, will probably be used to operate a regular mail and passenger service across the North Atlantic Ocean. No details are yet available, but it is understood that arrangements have already been made for transatlantic flights to be undertaken almost as soon as the vessel is ready. They are expected to take place somewhere between July and October of this year, and the first of them will be made to either Lakehurst or Miami.

It is interesting to note that a Zeppelin service is also to be established this year in Japan. A company known as the Pacific Airways Co. has been formed to run services between Tokio, Hsingking and Singapore.

A 200 m.p.h. Amphibian

Amphibians and flying boats generally are much slower than landplanes of similar size and power, but an American amphibian that has recently been produced compares favourably in speed with that of many landplanes. The machine is the Sikorsky S.43, which is of the twin-engined type and is capable of carrying between 16 and 25 passengers at a maximum speed of 200 m.p.h. and a cruising speed of 181 m.p.h. Even with one engine out of commission the machine can maintain a speed of 125 m.p.h. It stalls at 65 m.p.h. and can carry a load of about 7,500 lb.

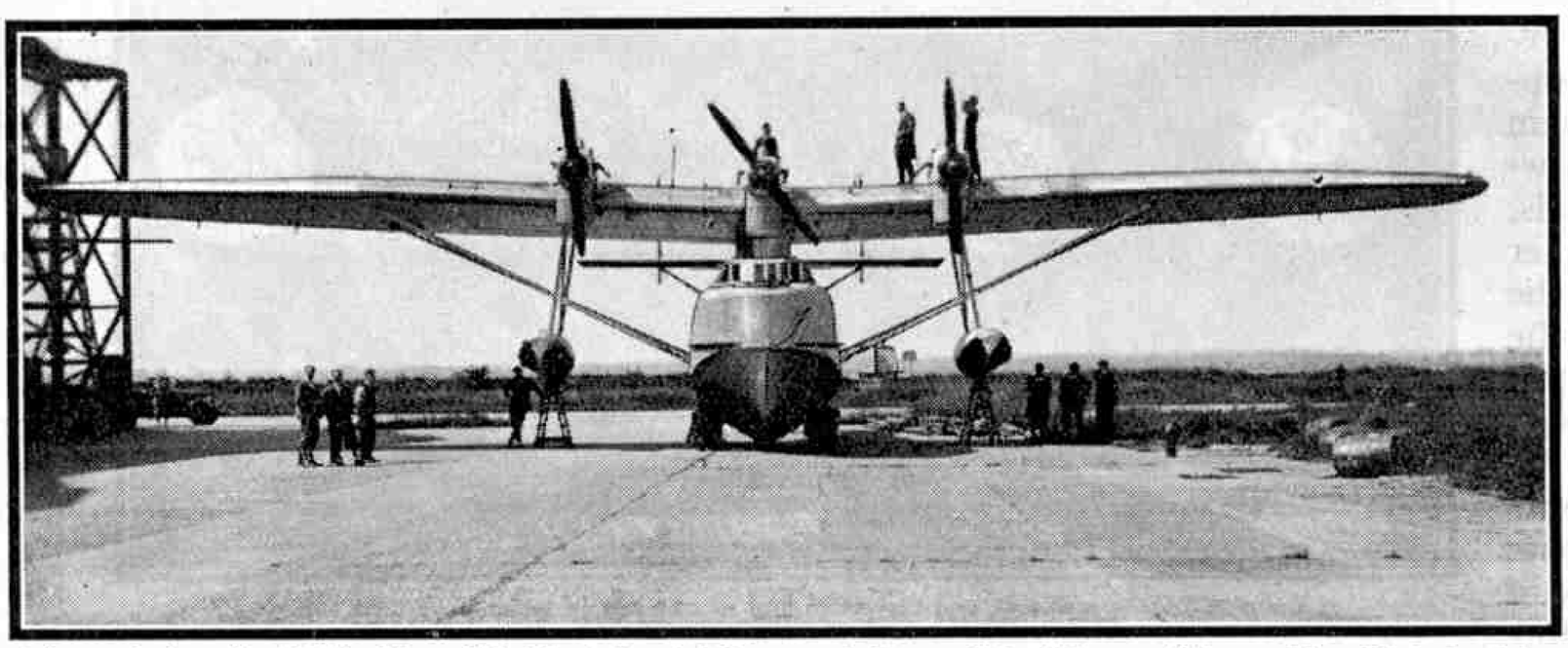
The new amphibian is provided with a semi-cantilever wing, retractable wing tip floats, and variable pitch airscrews. The hull is of semi-monocoque construction, and is built with special watertight compartments to eliminate any danger of foundering. Two engines of the Pratt and Whitney "Hornet" type are used, each of them developing 750 h.p.

An air line company with a base at Hawaii has already ordered two of these machines and placed tentative contracts for two others; while Pan-American Airways Inc., the famous American air line company, have ordered four of the amphibians for service on their lines.

New Avro Machines

Two new machines of the low wing monoplane type are now being built by A. V. Roe and Co. Ltd. These machines, known as the "652" and the "650," are both provided with cantilever wings and fuselages of welded steel tube. The "652" is the bigger of the two, being a high-speed passenger carrier with accommodation for six passengers and a crew of two. It is fitted with two Armstrong Siddeley "Cheetah" engines, each developing 270 h.p. at 2,100 r.p.m., which give the machine a cruising speed of 150 m.p.h., a maximum speed of 175 m.p.h. and a landing speed of 64 m.p.h. The range at cruising speed is nearly 500 miles.

The "652" is fitted with a retractable undercarriage, but the "650," which seats two pilots and four passengers, has an undercarriage of the fixed type. This machine employs two Armstrong Siddeley "Genet VII" engines each developing 135 m.p.h. and it has a maximum speed of 165 m.p.h. and cruises at 140 m.p.h. with a range of about 420 miles.



A forward view of a big Blackburn flying boat showing the remarkably small frontal area of the machine. Photograph by courtesy of the Blackburn Aeroplane and Motor Co. Ltd.

Interesting Canadian Seaplane

An interesting seaplane accommodating eight passengers has been designed and produced by Fairchild Aircraft Ltd., of Longueuil, Quebec. It is of the high wing monoplane type, 35 ft. 6 in. in length and has a wing span of 58 ft. The machine is known as the "Super 721" and is equipped with a Pratt and Whitney "Wasp" T.I.D.I. engine of 520 h.p., and has a range of 600 miles at a cruising speed of 120 m.p.h. The cabin walls are insulated against heat, cold and noise. A door in the front bulkhead enables a change of pilots to be effected while the machine is in flight.

Non-Stop Across the Pacific

A non-stop flight across the Pacific Ocean from Honolulu to Oakland, California, was made on 11th January last by the American airwoman Mrs. George Putnam, better known as Amelia Earhart. She made the flight of 2,408 miles in 18 hrs. 15 min., using a Lockheed "Vega" high wing cabin monoplane fitted with a Pratt and Whitney "Wasp" engine developing 150 h.p.

Although all flights of this nature are of course extremely hazardous, Miss Earhart took every precaution that was possible. Her machine was equipped with two-way radio with which she was able to get into touch with ships and land stations throughout the flight; and also was fitted with inflatable bags that would keep it afloat for some time in the event of its having to come down in the water. Another device for such an emergency was a balloon that could be blown up and allowed to rise into the air on a cable 100 ft. in length, to assist searchers both in the air and on the sea to locate the aeroplane. The pilot wore an inflatable suit throughout the flight.

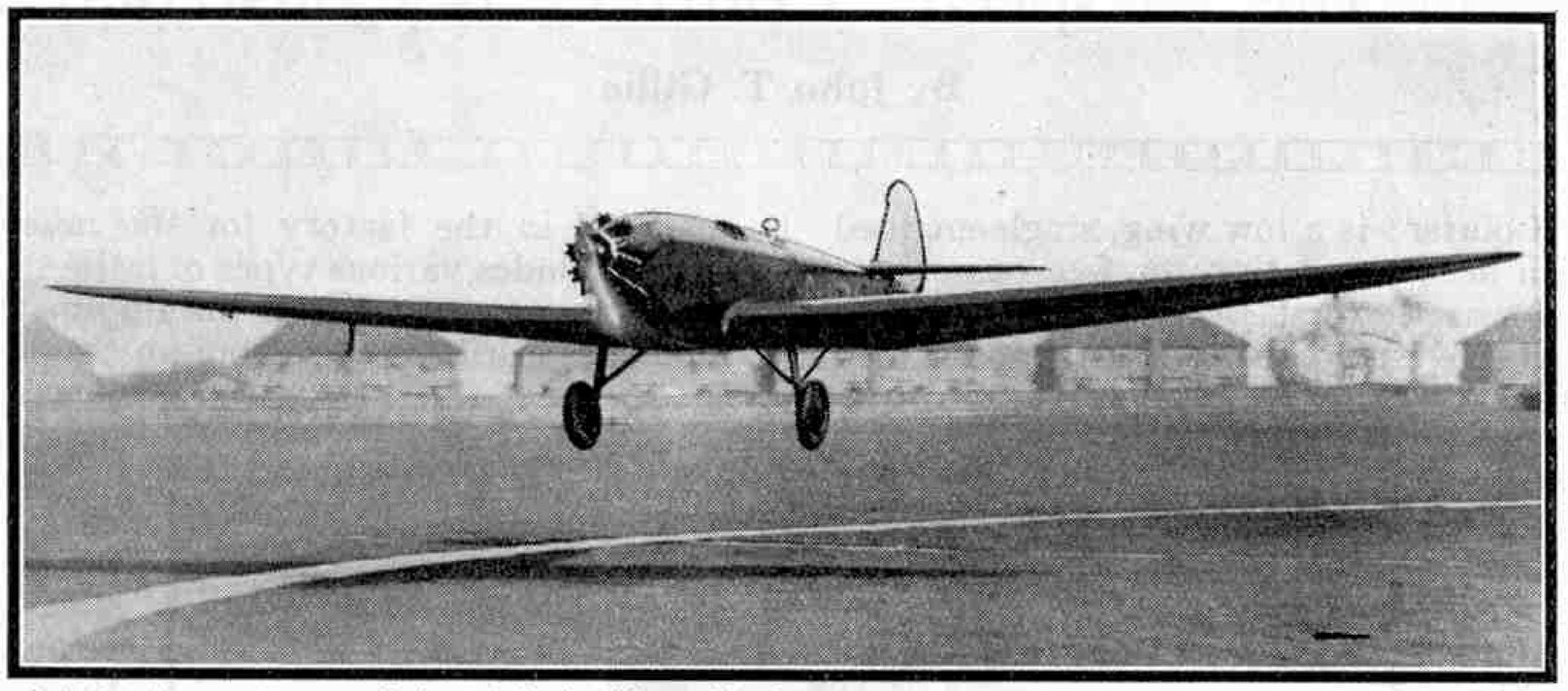
Assisted Flying Training

An interesting scheme to help young men who would like to learn to fly, but are unable to do so owing to the comparatively high cost of training, has been announced by the Air League of the British Empire. The Air League are prepared to pay half the cost of training. Applicants for this assistance must be at least 17 years of age, must join the Air League, and must be able to pass the medical examination that is required of all civil pilots. Applicants will not be required to put down the whole of their share of the training cost in advance, but will be able to pay for each lesson as it is taken. The course of instruction will be available at any light aeroplane club in the country and may be taken at any time. The scheme has been approved by Lord Londonderry, Secretary of State for Air.

A Pobjoy Aeroplane

A change in policy seems indicated by the news that an aeroplane is shortly to be produced by Pobjoy Air Motors Ltd. of Rochester Aerodrome. This firm, which until recently was situated at Hooton Park Aerodrome, near Liverpool, has confined itself so far to the manufacture of aero engines, in which field considerable success has been achieved, an aeroplane equipped with Pobjoy engines winning the King's Cup Air Race last summer. Remarkable flights have been made also by the Pobjoy - engined Comper "Swift."

Very few details of the new Pobjoy aeroplane are yet available, but it is stated that the machine will be a high wing monoplane of the cabin type and will accommodate three people, although it will be equipped with a Pobjoy "Niagara" engine developing only 98 h.p.



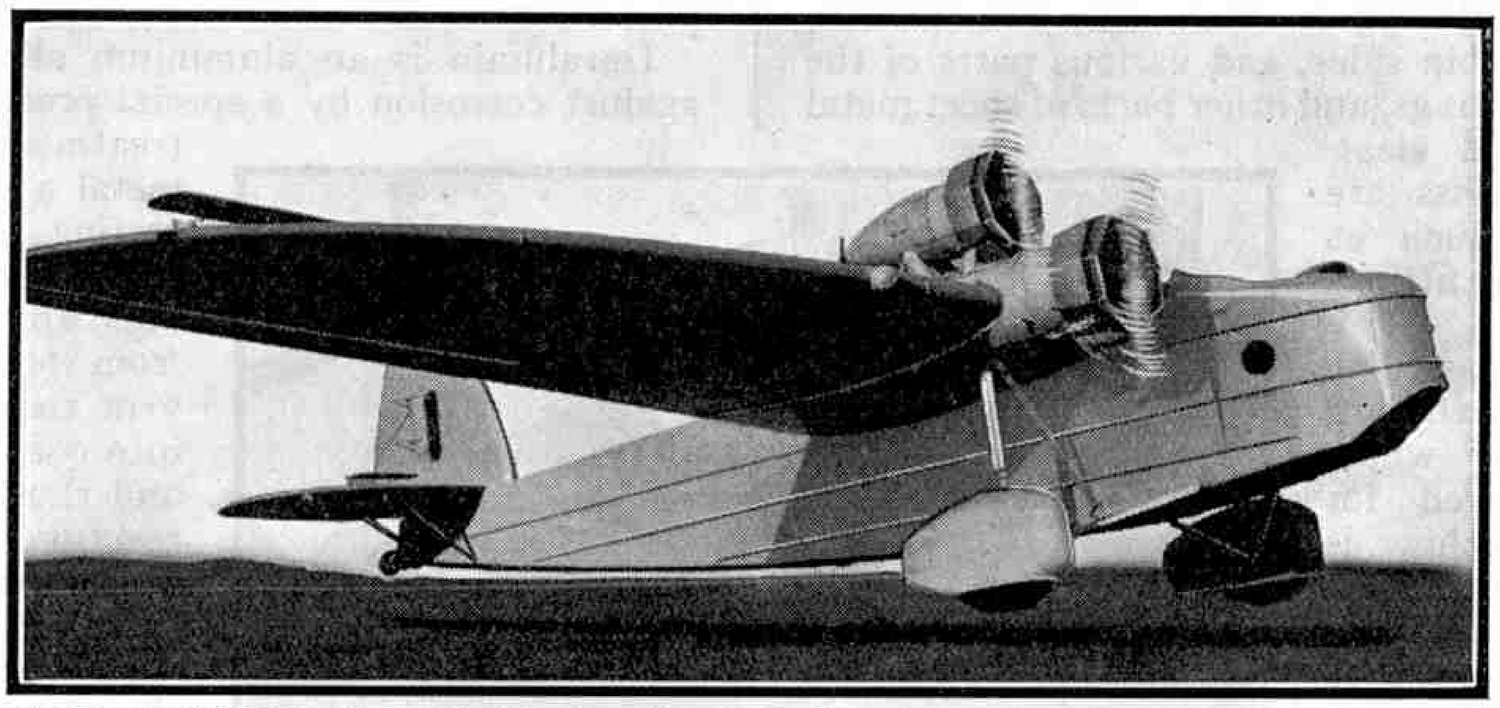
A British Klemm "Swallow" about to land. This machine is not, as mentioned on page 13 of our issue for January last, in course of development, but was actually the first aeroplane to be produced by the British Klemm Aeroplane Co. Ltd., to whom we are indebted for this photograph.

An Interesting Dornier Bomber

The lower illustration on this page shows the Dornier "Do.Y," a machine built by a branch of the Dornier Company with headquarters in Switzerland. It is of special interest because of the unique disposition of the engines, two of these being mounted in the cantilever wing, and the third in a nacelle held above the wing by means of struts.

The machine, which is intended for service as a bomber, when it is capable of carrying a crew of four, is of metal construction. The wings, which are covered with fabric, are 91 ft. 10 in. in span, and the fuselage, of monocoque construction, is 59 ft. 9 in. in length. Two of the occupants of the machine are accommodated side by side in an open cockpit well forward of the wing, while in front of them there is accommodation for a gunner who acts as bomb aimer and can also operate radio or camera equipment. His cockpit communicates with the pilots' cockpit by a narrow passage. The rear of the machine is protected by two openings to enable a rear gunner to operate guns above and below. Fuel is carried in two wing tanks each of 220 galls. capacity and situated one on each side of the fuselage.

British engines are employed in the "Do.Y," the Bristol "Jupiter VI" having been selected. The three engines give the machine a maximum speed of 155.25 m.p.h. It has a cruising speed of 136.6 m.p.h., a range of 930 miles and lands at 56 m.p.h.



The Dornier "Do.Y," a triple-engined bomber with seats for four. It has a maximum speed of 155.25 m.p.h. Photograph by courtesy of A.G. für Dornier-Flugzeuge.

Vacancies in R.A.F. Reserve

The Air Ministry announce that numerous vacancies exist in the R.A.F. Reserve, for initial training in flying. Applicants must be of good education and under 25 years of age. No experience of flying is required as a free and complete course of instruction will be given to successful applicants. The initial period of service in the Reserve is five years.

Full particulars are given in A.M. Pamphlet No. 56, and copies of this, together with the necessary application forms, can be obtained from the Secretary, Air Ministry (S.7(c)), Kingsway, London, W.C.2.

Deutsche Luft Hansa Progress

The steady progress made by the North Atlantic mail service of Deutsche Luft Hansa during the six years it has been in operation is shown by the 1934 traffic figures recently published. As *"M.M."* readers know, the seaplanes employed are catapulted from the German liners *"Europa"* and *"Bremen"* when these are hundreds of miles from their destination.

Last year 18 flights were made from the liners to New York, the total distance flown being 14,306 miles, in comparison with three flights, covering a total distance of 309 miles, made in 1929. Eastward flights last year, to Southampton and Bremerhaven, amounted to 18 and a total distance of 23,545 miles was covered, whereas six years ago only four flights were made in this direction, the total distance then flown being 1,367 miles.

Internal Air Lines for France

A new French air line company, known as the Air Bleu, has been formed to operate internal air services between Paris and a number of important French cities. To begin with, services will be operated to Strasbourg, Lille, Le Havre, Nantes, Bordeaux and Toulouse, and other towns on the way to these. The company will not be subsidised in any way, but it will carry mails, and will of course receive the usual payment for this work.

Several machines of the Caudron "Simoun" type have been ordered for use on the service. These are of the low wing cabin type and are capable of carrying three or four passengers. They have a maximum speed of 168 m.p.h., land at 49 m.p.h. and can carry a pay load of 640 lb. for a distance of 845 miles on one filling of petrol. A Renault "Bengali" engine developing 118 b.h.p. is used.

A 60-Seater to Travel at 200 m.p.h.

Capt. Hugo Sundstedt, a well-known American designer, has produced plans for a long-distance flying boat capable of carrying 60 passengers at a high speed, and eminently suitable for the operation of a regular transatlantic air service.

The machine is a cantilever monoplane of the high wing type and has only two engines, arranged in the wing so that they can be adjusted or repaired while in flight, and connected by shafts to three-bladed airscrews 18 ft. in diameter. A definite decision about the type of engine to be employed has not yet been made, but Diesel engines of 4,500 h.p. are favoured at the moment. The passengers are carried in a two-storey hull supported on two long floats built integral with the fuselage.

It is estimated that the machine should be capable of cruising at a speed of 245 m.p.h. and of attaining a maximum speed of 275 m.p.h. The landing speed should be under 60 m.p.h. When carrying a pay load of 14,600 lb., the flying boat should have a range of 3,000 miles.

More R.A.F. Aerodromes

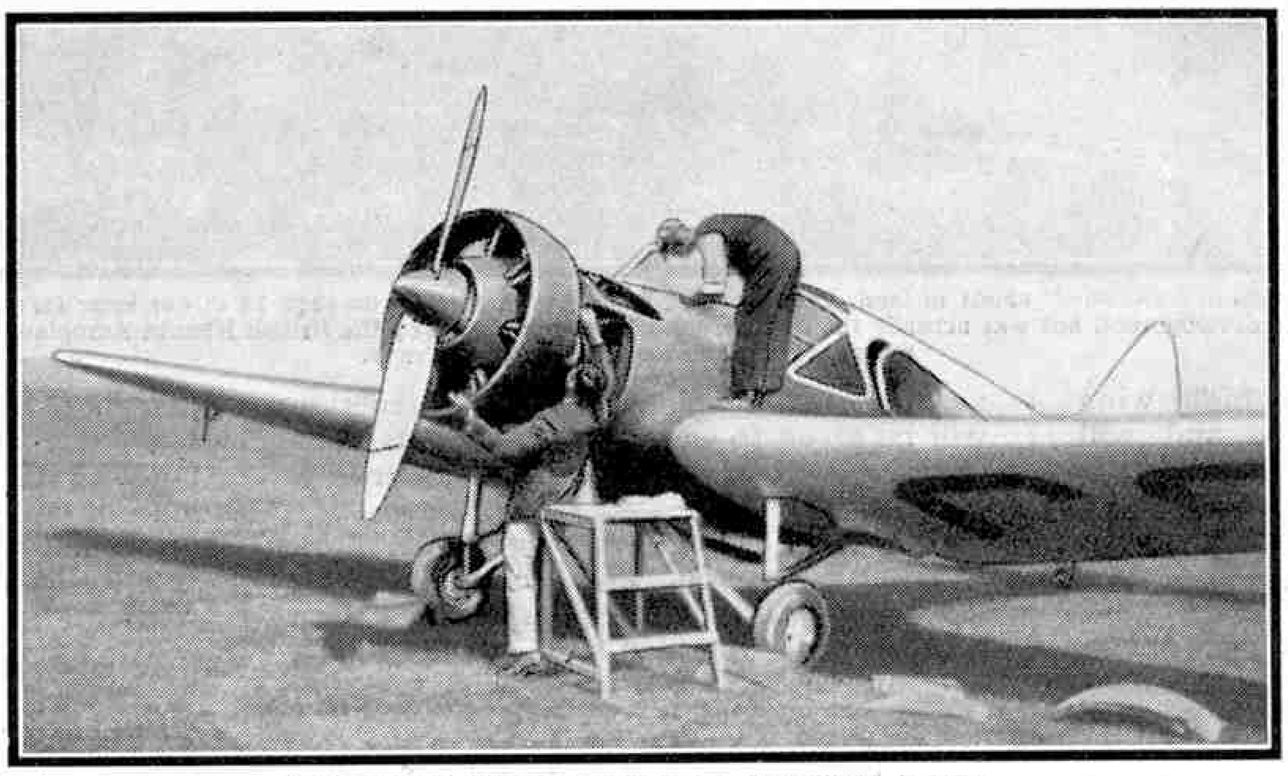
During the last six months the Air Ministry have chosen sites for several additional Royal Air Force aerodromes. The three latest sites are at Harwell, near Didcot; Stradishall, five miles from Clare, in Suffolk, and at Ternhill, a few miles from Market Drayton.

Building a Modern Aeroplane

How the Airspeed "Courier" is Constructed

By John T. Gillie

THE Airspeed "Courier" is a low wing, single-engined monoplane with accommodation for five passengers and the pilot, and was the first British machine to be fitted with a retractable undercarriage. It is constructed by Airspeed Ltd. in their factory at the Portsmouth Municipal Airport. This is a building of the "north light" type, that is one with inclined roof windows facing north so that sufficient daylight penetrates into it, while the heating rays of the Sun are excluded.



Putting the finishing touches to an Airspeed "Courier."

The production of the "Courier" begins in the drawing office, where draughtsmen working under the chief designer are occupied in the production of drawings of each part to be made. Each part has a separate number, and more than 3,500 of them go to make up the "Courier." They can roughly be divided into three classes according to the material of which they are made. Those of one class are of wood, and include spars, cabin sides, and various parts of the fuselage; cowlings, fairings, and other parts of sheet metal make up the second class; and in the third class are solid metal parts, such as joint plates, fuselage fittings and axles.

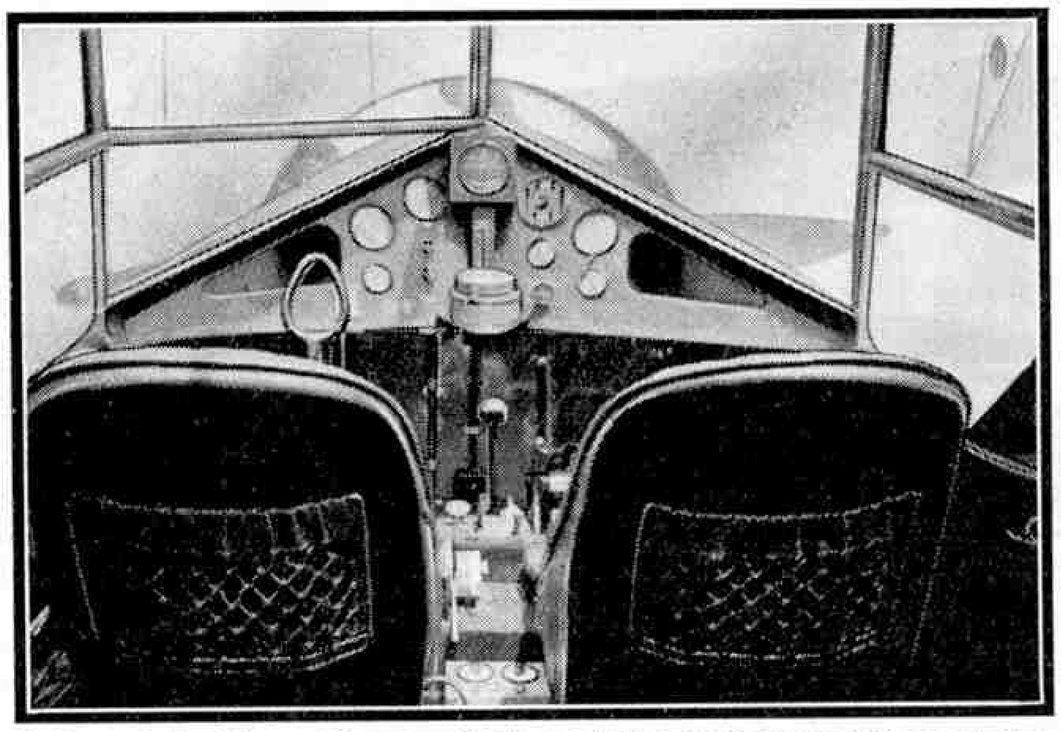
The drawings are passed to the planning department, where the dates by which each part is required for assembly in the machine is decided. A "production order" is then issued and sent with the drawing of the part to the shop foreman, who allocates the job to one of the craftsmen.

In the case of sheet metal parts, a wooden "jig," that is a replica of the finished part, is first constructed and the sheet metal for the part is shaped on it. Jigs are also constructed on which to shape wooden parts such as ribs and spars, and these are left on the jigs for a considerable period so that on removal the wood will retain its shape, and any glued section will have dried.

The chief metallic components used in construction are steel tube, steel sheet, duralumin tube, duralumin bar and aluminium tube, and the elaborate plant installed in the factory for the manufacture of metal parts includes various types of lathes, nibbling machines, which cut the steel and duralumin sheet to size, and high-speed drills driven from an overhead shaft deriving power from electric motors.

All steel parts of course have to be protected against corrosion, and this is achieved by plating them with cadmium. Ordinary painting of the metal would not suffice, for this might become scratched during the assembly, and rusting would follow, causing loss of strength that cannot be permitted in aircraft design. Cadmium plating has been found to be the most satisfactory form of protection. Cadmium is a white metal and is deposited by an electrolytic process, when it actually eats into the steel to form a surface alloy that is absolutely corrosion proof.

Duralumin is an aluminium alloy and is protected against corrosion by a special process known as anodic treatment, which gives the metal a very hard skin, protecting the metal from corrosion. The protective coatings applied to parts made from this alloy and steel prevent the metals from coming into contact with each other, and thus the electrical interreaction that usually occurs when the two are employed together on aircraft is avoided.



In the cockpit of the machine, showing the controls and the instrument board. The "spade" grip of the control column can be seen in front of the pilot's seat.

As the parts are finished they are carefully stamped with the part number and job number, and then passed to the inspection department, where they are subjected to the most rigid tests. In aircraft construction the methods of inspection are stricter than those employed for any other manufactured product, and every part is stamped by the inspector before it is passed into stores to be stowed away until required for assembly. All materials must be purchased from firms approved by the Air Ministry, and each consignment is covered by a release note, by which it is possible to trace its source.

The actual assembly of the parts is carried out in

separate sections in which the front fuselage, the centre section and undercarriage, the main planes, and the empennage, incorporating the tailplane, elevators, fin and rudder, are dealt with respectively.

The front fuselage is constructed of special panels of plywood, and welded steel tube is employed for the front section from the engine bulkhead to the instrument board. The centre section is also of plywood, with spruce longerons and bulkheads.

This photograph shows the excellent lines of the Airspeed "Courier."

The undercarriage is of special interest. It is made to retract upward and backward into the wing so that only the lower third of each wheel protrudes through the lower surface of the wing, and is operated by a hydraulic pump system. A double-ended ram is used, the piston of which is moved up and down by exhausting oil from one side of it and forcing it in at the other by means of a double-acting pump in the cockpit. To raise the undercarriage, the pump handle in the cabin is operated by the pilot, and the lower ends of the front shock-absorber leg and axle then are pulled upward and backward, finally coming to rest in a shaped recess in the underside of the wing. When the undercarriage is in this position drag is reduced to such an extent during flight that about 30 m.p.h. is added to the speed of the machine.

A very effective warning system is incorporated to prevent the pilot from attempting a landing with the undercarriage up. This consists of a specially designed indicator, fitted on the dashboard, in which are lights that show the position of the landing wheels immediately the throttle of the machine is closed in readiness for a landing. A green light is shown when the undercarriage is in the down position; a red one appears if it is retracted, and an orange light indicates that it is in an intermediate position. In addition an electric horn sounds when the throttle is closed with the undercarriage in the raised position, and draws the pilot's attention to the red light. It is interesting to note that the "Courier" has actually been landed with the undercarriage retracted, and only slight damage, beyond a broken propeller, was caused to the machine.

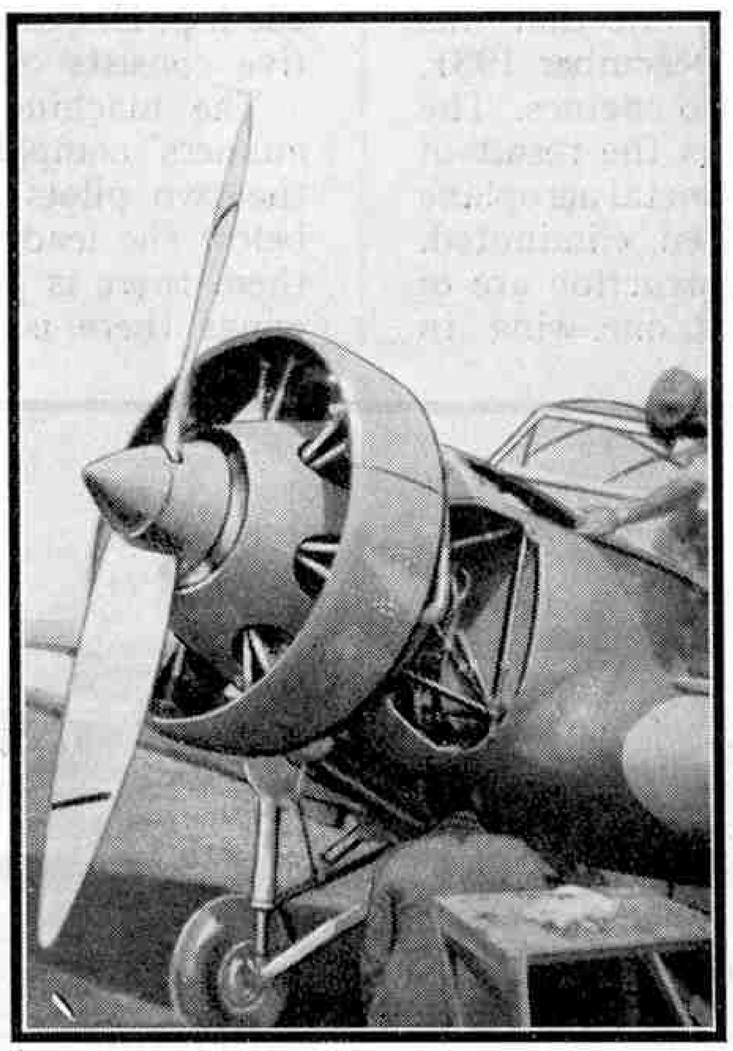
While the front fuselage, centre section, and undercarriage are under construction, work on the wings also is proceeding in another part of the factory. The wings are made of spruce and birch ply, the plywood consisting of three laminations with the middle layer twice as thick as those enclosing it. They are covered with fabric, which is sewn by women, and have a total area of 250 sq. ft., requiring 150 yds. of fabric.

The tail unit has a wooden framework covered with fabric, and when it is completed the various sections of the fuselage are assembled together in readiness for doping. A special room is necessary for this process, because a constant temperature must be maintained in order to produce the best possible finish. The room at the factory of Airspeed Ltd. is very large, and two 24-in. propeller fans with enclosed motors that revolve at 550 r.p.m. keep up a constant circulation of fresh air. The walls of the "dope room" are sheeted inside and out with asbestos, and the structure therefore is proof against fire.

The equipment for doping consists of a pressure plant that delivers a steady air supply to the air pistols, which spray the dope at a pressure of 40-50 lb. per sq. in. An air filter is incorporated in the system in order to trap moisture or oil from the compressor.

The fuselage is first treated with a synthetic primer dope for protection from moisture. This is applied to the bare plywood with a stiff bristle brush and rubbed well into the grain. One or two coats of synthetic undercoat dope are next applied by spray, the wood being rubbed down between each application, and the fuselage is then ready for the final protective covering of the desired shade.

The wings are of fabric and require a rather different treatment. First a coat of red dope is applied by brush in order to ensure thorough penetration of the fabric, and when this has dried for half an hour a further coat is sprayed on and allowed to dry overnight. The protective finish can then be applied. The registration letters are next painted on and the wings are ready for attachment to the fuselage.


A Townend Ring is fitted to the engine if the machine is equipped with an Armstrong Siddeley "Lynx" IV C or an Armstrong Siddeley "Cheetah."

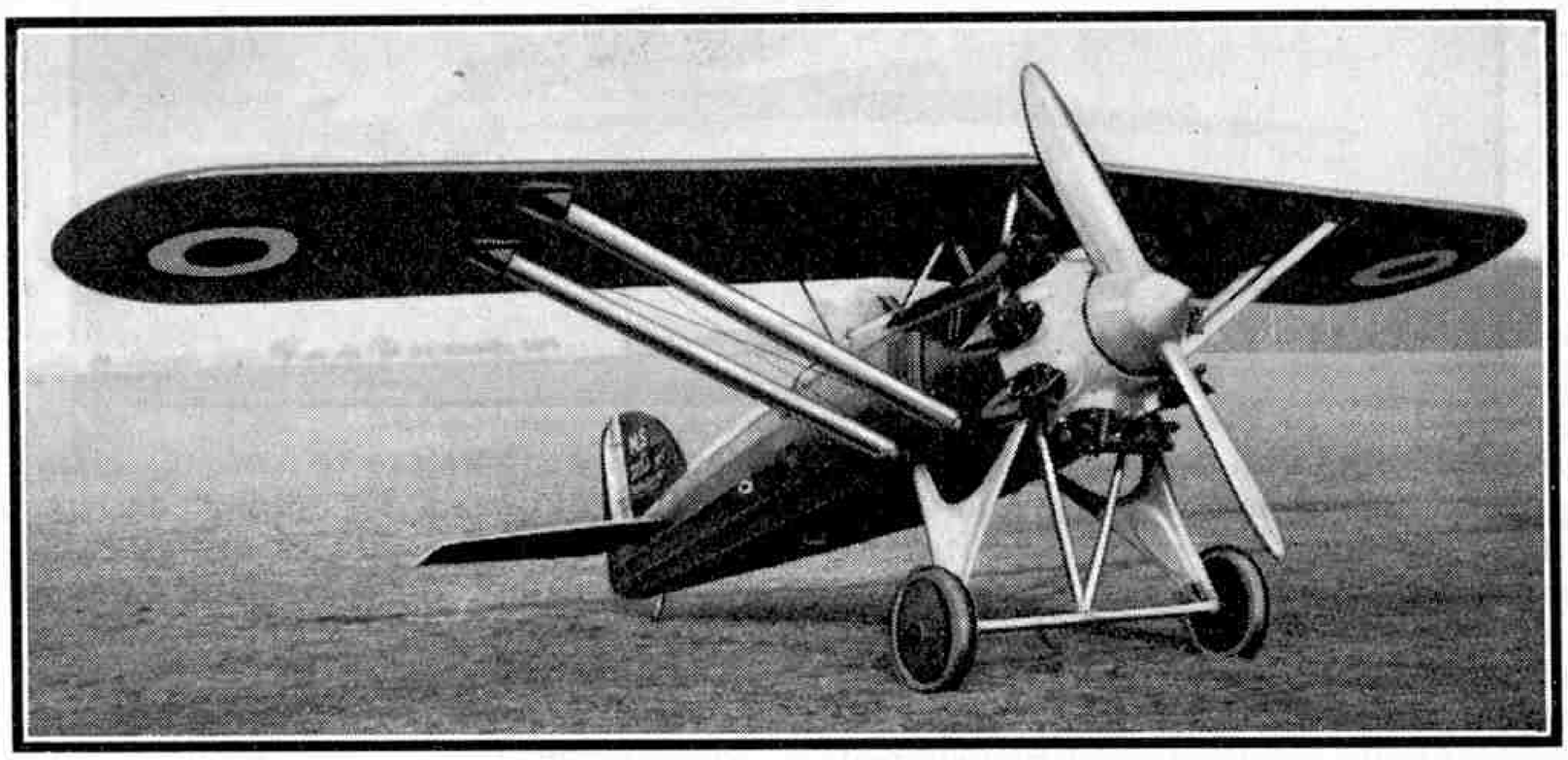
While the wings are undergoing dope treatment the engine is fitted to the fuselage on a welded steel tube mounting. The engine may be the Armstrong Siddeley "Lynx" IV C, the Armstrong Siddeley "Cheetah," or the Napier "Rapier," according to the choice of the purchaser. A Townend Ring is fitted as standard if the "Lynx" or "Cheetah" is installed. These two engines are of the radial air-cooled type, and the fitting of the Townend Ring increases the speed of the machine by about 15 m.p.h.

Petroflex tubing is fitted to connect the fuel system with the engine, and two 38-gallon tanks are installed between spars in the centre section. (*Continued on page 186*)

Popular Foreign Aeroplanes

Civil and Military Machines of France and Holland

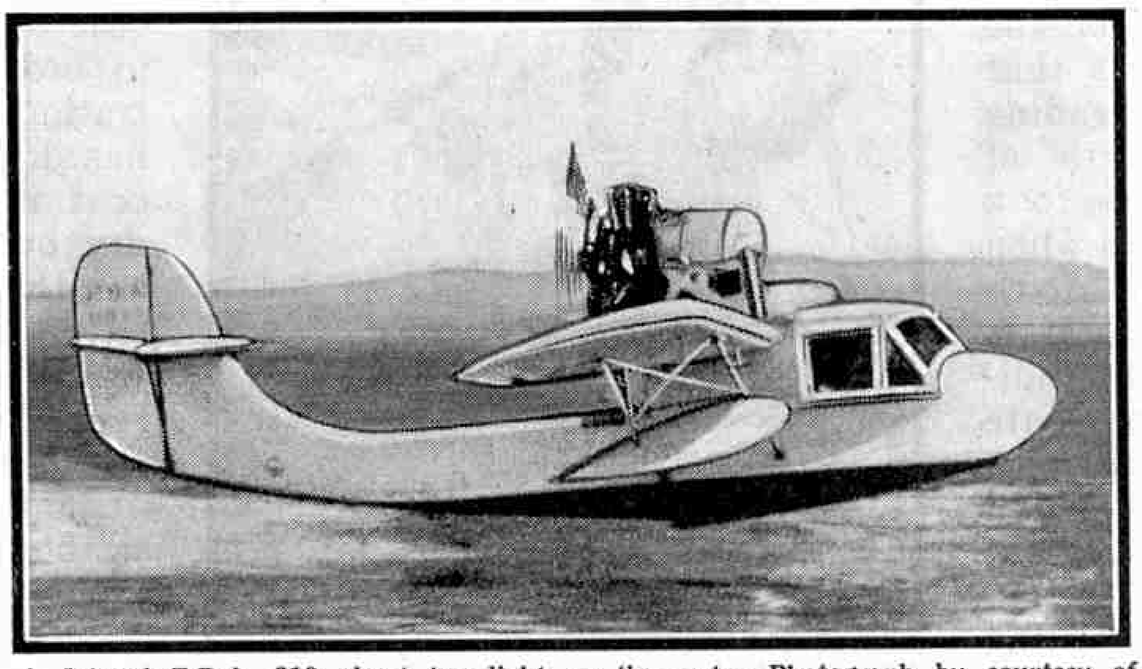
FOR this month's article we have selected four aeroplanes, three French and one Dutch, that are quite different from one another, but are all of outstanding importance and interest. These are the Breguet 41, the Fokker F.IX, the Morane-Saulnier 222, and the Schreck-F.B.A.310. Two of these machines, the Breguet and the Morane-Saulnier, are military types, but the others have been designed for civil use, the Schreck-F.B.A. being a small cabin amphibian, and the Fokker a big triple-engined air liner.



The Morane-Saulnier 222, a single-seater parasol fighter. Photograph by courtesy of Aeroplanes Morane-Saulnier.

The Breguet machine that we illustrate is very similar in design to one that was described on page 971 of our issue for December 1931, but is a little bigger and makes use of two engines. The machine is very unusual in design and is the result of many years' experiment to produce an all-metal aeroplane in which all unnecessary drag had been eliminated.

Machines built on this method of construction are of the sesquiplane type, which means that one wing, in Breguet machines the lower one, is smaller than the other. The wings are fairly normal in construction, and are of the cantilever type, although to provide additional support one "V" strut sloping outward is provided on each side of the fuselage, which is the most unusual part of the machine. The front and middle sections of this are perfectly normal, but behind the rear cockpit the fuselage abruptly comes to an end and a single girder protrudes to carry the empennage or tail unit. Although the machine is of metal, no welding is used in its construction, all the joints being made by rivets and, wherever possible, hollow rivets. No nuts and bolts are used.



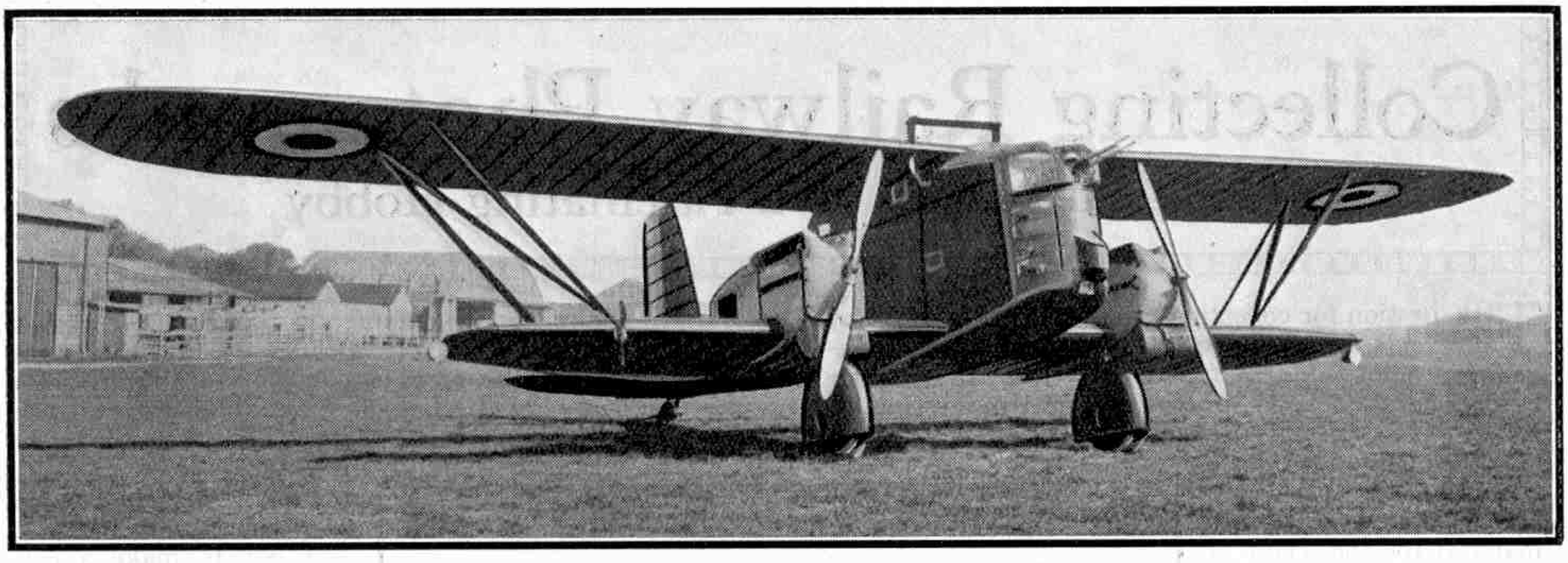
A Schreck-F.B.A. 310 about to alight on the water. Photograph by courtesy of Hydravions Schreck-F.B.A.

The first machine to be built on this principle was the 27, a two-seater observation machine with a span of 55 ft. 9 in. and a maximum speed of 165.5 m.p.h. when using a 500 h.p. Hispano-Suiza 12 H.B. 12-cylinder water-cooled engine. After operating experience had been gained with the 27, another similar machine was prepared. This was numbered the 39, and is a three-engined commercial biplane with accommodation for 10 passengers and a crew of two. It has a span of 68 ft. and is able to travel at a speed of 174 m.p.h. This was in turn followed by the 41, which is illustrated at the top of the next page. It can be obtained in two versions, according as to whether engines cooled by air or water are employed. If the machine is fitted with water-cooled engines, two 650 h.p. Hispano-Suizas are employed; while the alternative consists of two Gnôme Rhônes of 625 h.p. each.

The machine is fitted with a completely enclosed gunners' compartment in the nose of the fuselage, and the two pilots are accommodated in an open cockpit below the leading edge of the wing. Beside and below them there is provision for a navigator, and aft of the wings there is room for a rear gunner who can fire through ports in the roof, or the floor, of the fuselage. The machine is 66 ft. 1 in. in span, and can travel at a speed of 192.5 m.p.h. and climb to an altitude of 13,120 ft. in nine minutes.

The Société Anonyme des Ateliers D'Aviation Louis Breguet, the manufacturers of this interesting machine, are one of the oldest aeroplane firms in France. They built the first French all-metal military aeroplane, hundreds of which have been sold in all parts of the world.

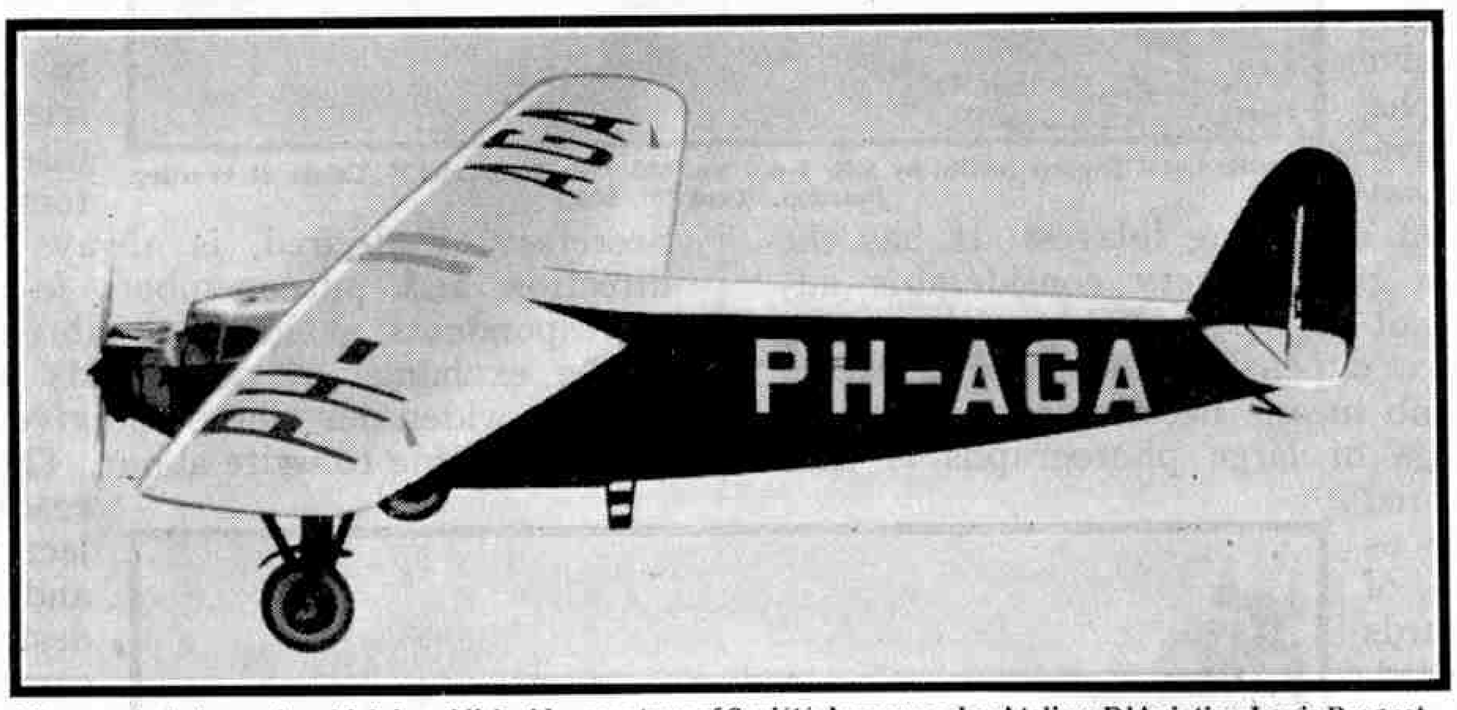
The Fokker F.IX is a popular machine in the well-known Fokker range. It is of the triple-engined type, and has accommodation for 20 passengers in a luxurious and airy cabin. Like most Fokker machines it is a high wing monoplane, the wing being of cantilever construction and made of spruce and plywood. The wing is also covered with plywood. The fuselage is of typical Fokker construction of welded steel tubes, and is braced partly



with tubes and partly with steel wires.

Two pilots are carried in the machine, and there is communication between the pilots' cockpit and the cabin, which is heated by hot air. Two luggage compartments are provided, one in the fuselage behind the central engine partly under the cockpit, and the main one in the rear of the cabin.

The F.IX is 89 ft. 3 in. in span and 63 ft. 4 in. in length. It weighs 11,681 lb. when empty and is capable of carrying a payload of 5,214 lb. Three Bristol "Jupiter" engines built under licence by the Gnôme-Rhône Company are fitted, and each of these develops 450 h.p. They give the machine a maximum speed of 134 m.p.h. and a cruising speed of 112 m.p.h. The range at cruising speed is 683 miles.



The upper photograph, which is published by courtesy of Société Anonyme des Ateliers D'Aviation Louis Breguet, shows the Breguet 41. The lower illustration is of the Fokker F.IX triple-engined air liner. This is published by courtesy of N.V. Nederlandsche Vliegtuigenfabriek.

The history of N.V. Nederlandsche Vliegtuigenfabriek is well known to readers of the "*M.M.*" Fokker aeroplanes are used in more than 30 countries, and are built under licence in 13 countries. The latest development of the company is that Mr. Fokker has at last decided to forsake the high wing cantilever monoplane and construct a low wing monoplane. He has secured the manufacturing and selling licence for the whole of Europe for the American Douglas D.C.-2 twin-engined transport machine that set up such a good show in the MacRobertson Air Race last year. The company have acquired also the right to distribute to all European cities the Lockheed "Electra" twin-engined transport monoplane.

The upper illustration on the previous page shows a typical Morane-Saulnier machine. It is an early version of the 225, which is now equipped with spats and has been generally cleaned up, although photographs of it are not at the moment available. The machine is a single-seater fighter and, as will be seen, is of the braced parasol monoplane type. The wings are made up of duralumin spars and wooden ribs, covered with fabric, and are 34 ft. 2 in. in span. The fuselage has a duralumin framework and is covered with sheet metal from the nose to the pilot's seat, behind which fabric has been used as a covering. The fuselage is 23 ft. 6 in. in overall length. Any engine of suitable power can be employed, but the standard type is the Gnôme-Rhône "Jupiter IX," which develops 500 h.p.

The latest version of the machine illustrated has a speed of 188 m.p.h. and is able to climb to an altitude of 16,400 ft. in 8 min. 24 sec.

Aeroplanes Morane-Saulnier is a well-known French firm manufacturing almost exclusively military machines. During recent years the firm have specialised in the production of two-seater training machines and they have now acquired the licence for manufacturing the D.N. "Gipsy Moth" in France.

The last of the four aeroplanes to be dealt with, the Schreck-F.B.A.310, is entirely different from any of the other three, for it is a small amphibian flying boat, or in other words a machine that can take off from and alight on either land or water. The machine is intended mainly for private flying, accommodating two people in a comfortable cabin. It is a high wing braced monoplane, the wings consisting of a wooden framework covered with fabric. The hull also is of wooden construction and is 24 ft. 11 in. in length. The wings are 39 ft. 4 in. in span.

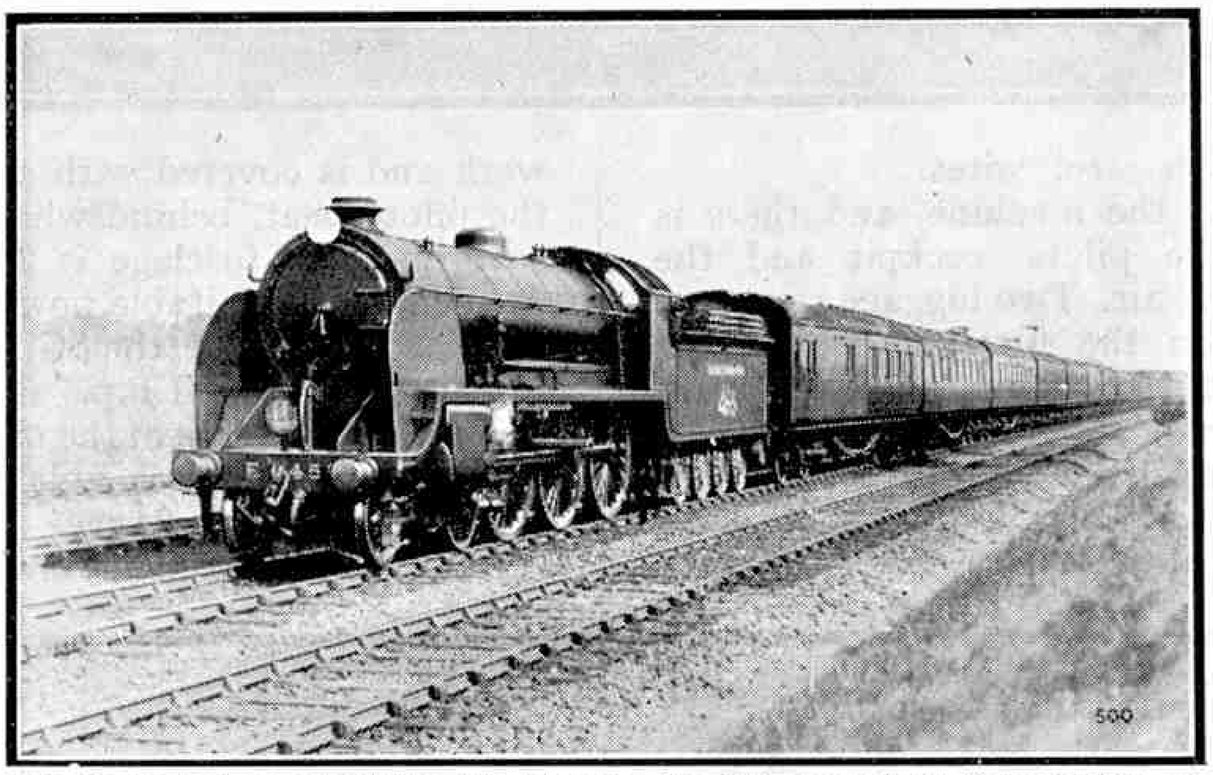
The machine is of very pleasing appearance, and is equipped with a single pusher engine mounted in a nacelle carried on struts above the wing. The engine usually employed is of the Lorraine air-cooled radial type. This develops 120 h.p., and machines of this type in which it is installed have a maximum speed of 93.15 m.p.h. and a range of 186 miles.

Hydravions Schreck-F.B.A., the constructors of the machine we have described, are another old French firm. They were a pioneer company in the development of the flying boat and have confined their products entirely to that type of machine.

Collecting Railway Photographs

Practical Advice on a Fascinating Hobby

THE passion for collecting things comes to most boys and finds expression in many different directions—stamps, coins, matchbox covers, tram tickets, and numerous other items. One of the most interesting and worth-while subjects for collection is railway photographs. Cigarette cards have from time to time provided a limited amount of useful material for this class of collection, but the acquisition of real railway photographs is much more fascinating, and it is with the collection of these that this article is concerned.



Atlantic Coast Express hauled by S.R. 4-6-0 No. 455 "Sir Launcelot." Taken at Worting Junction. (Card No. 500.)

The majority of boys are tremendously keen on railways and everything appertaining to them, and the building up of a comprehensive collection of photographs, illustrating past and present features of railway practice, is a hobby of absorbing interest. It has the further—and, to most people, very considerable advantage—that it is not a costly hobby. Of course, enlargements are more expensive, but the collection of large prints is by no means necessary or desirable. A further disadvantage of large photographs is that they cannot be stored away as conveniently as the post card size of photograph. Post cards are easily carried, handled, and stored. Best of all, the prices for photographic post cards are reasonable, so that although pictures of many sizes may be included in the collection, the handy post card forms an ideal standard unit to work with.

The railway companies publish some post cards showing different locomotives and trains, and post cards of famous expresses and other railway subjects may be bought in many stationers' shops. The majority of these are printed copies, however, whereas most collectors to-day prefer to collect only real photographs. These collectors are well catered for by Real Photographs Co., of 9, Union Court, Liverpool, a firm that has consistently advertised in the "*M.M.*" for many years. This firm's photographs include negatives by such famous railway photographers as Mackay, Earley, Coulter, and by numerous other photographers who have become equally well-known for this class of work. They also include official photographs from the different railway companies, and whilst the quality of the work is very high, the prices are exceptionally low.

Down Birkenhead Express hauled by G.W.R. 4-6-0 No. 5002 "Ludlow Castle." Taken at Twyford. (Card No. 731.)

Apart from this source of purchase, anyone who sets out to make a collection will find that pictures come to him in many ways. For instance, some readers no doubt correspond with friends overseas and in foreign countries, or have friends who do so, and it is not difficult to obtain railway photographs through these channels. If the reader is not fortunate enough to be in touch with friends overseas who are interested in railway matters, the Meccano Guild Secretary, if desired, is always able to help in this direction and put members in touch with suitable correspondents at home or abroad.

The exchange of post cards with friends overseas helps to widen our views, and give us something definite and interesting to write about. There are many "*M.M.*" readers abroad who collect railway photographs, and they are naturally desirous of exchanging cards of their own country with those showing British engines and trains. The exchange of photographs also means the exchange of ideas between collectors, and in this way much interesting information may be gathered and valuable additions made to one's collection.

From such sources as these, then, does the collector obtain his photographs, and by keeping a constant lookout for new types and additions as opportunity occurs, anyone who cares to do so can in time acquire a large representative collection that is of great interest and value.

Perhaps a word should be added as to the methods of keeping such a collection of photographs. Appropriate grouping and an orderly sequence should be aimed at, for a collection that is kept haphazard and without

order loses much of its interest and value.

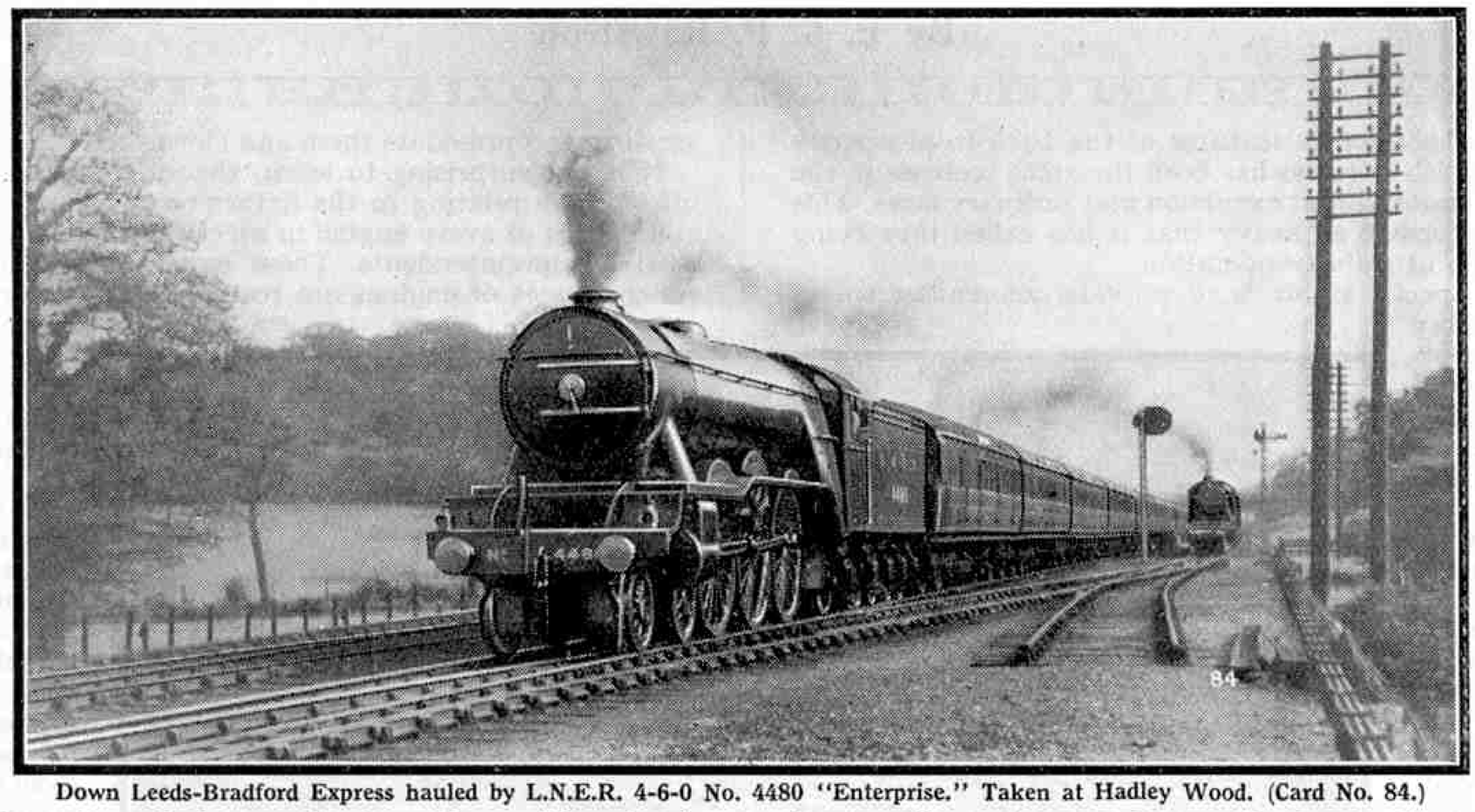
For post cards, albums are very convenient, and enable the items in the collection to be readily passed in review. Another plan is to keep the photographs in envelopes, as in that way they are preserved clean and undamaged at the corners, and are less likely to fade. An album has the disadvantage that one cannot keep a steadily-growing collection arranged systematically without a constant rearranging of the cards.

When the collection grows to larger proportions, more elaborate methods of filing are desirable. Cabinets to hold post card size cards, together with sets of guide cards, are listed by the firm Real Photographs Co. These specially-designed cabinets form an admirable means of storing photographs, being both convenient, compact, and dust-proof. As the collection grows, the cards may be transferred to the special two or four-drawer cabinets listed by the same firm. These drawer cabinets are by far the most economical and neatest means of storing the collection.

Each collector will follow his own ideas and preferences in the order of grouping the older types together, according to the particular period in locomotive history to which they belong. In other cases photographs of locomotives, etc., belonging to the same railway can be grouped together. Differently coloured guide cards make it possible to arrange the collection on almost any system. It is here that the orderly habits and organising powers of the individual collector find a means of expressing themselves.

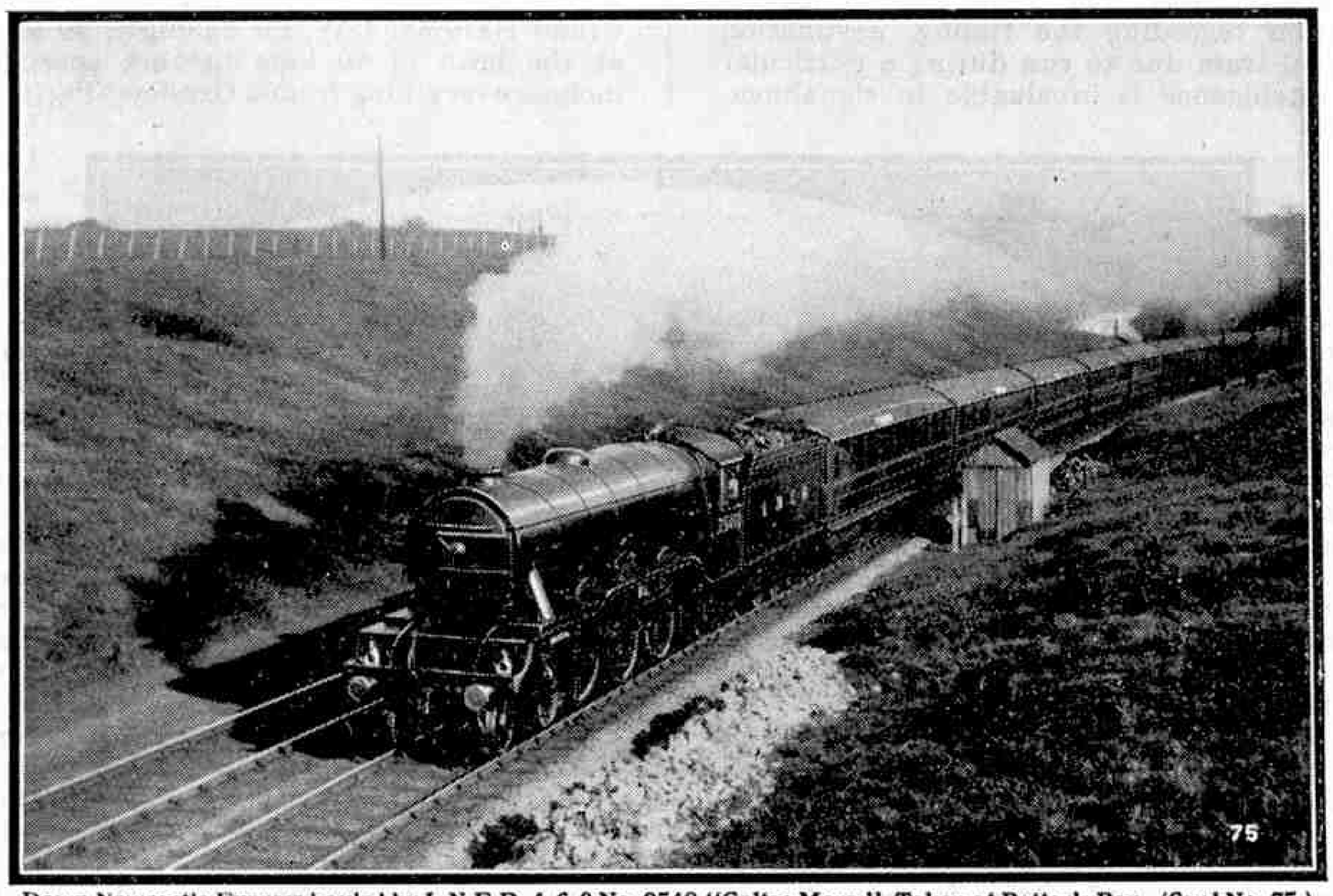
The exact character of the collection will be determined largely by the special interest of each collector. Whereas one will concentrate on a particular railway and get every possible picture representative of it, another will be universal in his tastes and will include foreign and colonial as well as British railways.

A particularly interesting aspect of collecting photographs of locomotives is that these take on an added interest when the locomotives illustrated are withdrawn from service and are relegated to the scrap-heap. The photographs then form a useful record of locomotive development of the railway concerned. Those who start a collection of photographs now will be able to look back in years to come on some of their early-acquired treasures. Imagine, for instance, looking at a print of the *"Cock o' the North"* or *"Princess Elizabeth"* in 50 years time!



Down Leeds-Bradford Express hauled by L.N.E.R. 4-6-0 No. 4480 "Enterprise." Taken at Hadley Wood. (Card No. 84.)

The Real Photographs Company also produce a remarkably fine series of aeroplane photographs, which includes some 200 titles embracing all kinds and types of aeroplanes both flying and on the ground. Two of the most interesting machines included in the list are the Vickers-Supermarine Rolls-Royce S.6B, in which the last contest for the Schneider Trophy was won, and the De Havilland "Comet" that won the 1934 Air Race to Australia. There are also excellent photographs of a Vickers "Victoria" troop carrier similar to the machines in which the evacuation of Kabul was carried out, the Fairey Night Bombers, "Dragons," "Autogiros," "Sidestrands," and so on.



Down Newcastle Express hauled by L.N.E.R. 4-6-0 No. 2548 "Galtee More." Taken at Potter's Bar. (Card No. 75.)

A further list from the same firm caters for ship lovers, and includes naval craft, sailing ships, and a representative selection of the world's famous liners of all nationalities —*"Queen Mary," "Mauretania," "Leviathan," "Georgic," "Rex,"* etc.

All the photographs in these three series—railways, aeroplanes and ships—are excellently produced, each is a hand made print, and we can recommend *"M.M."* readers who are at all interested to commence and maintain a collection of them. It is a hobby they will never regret taking up and the educational value is enormous.

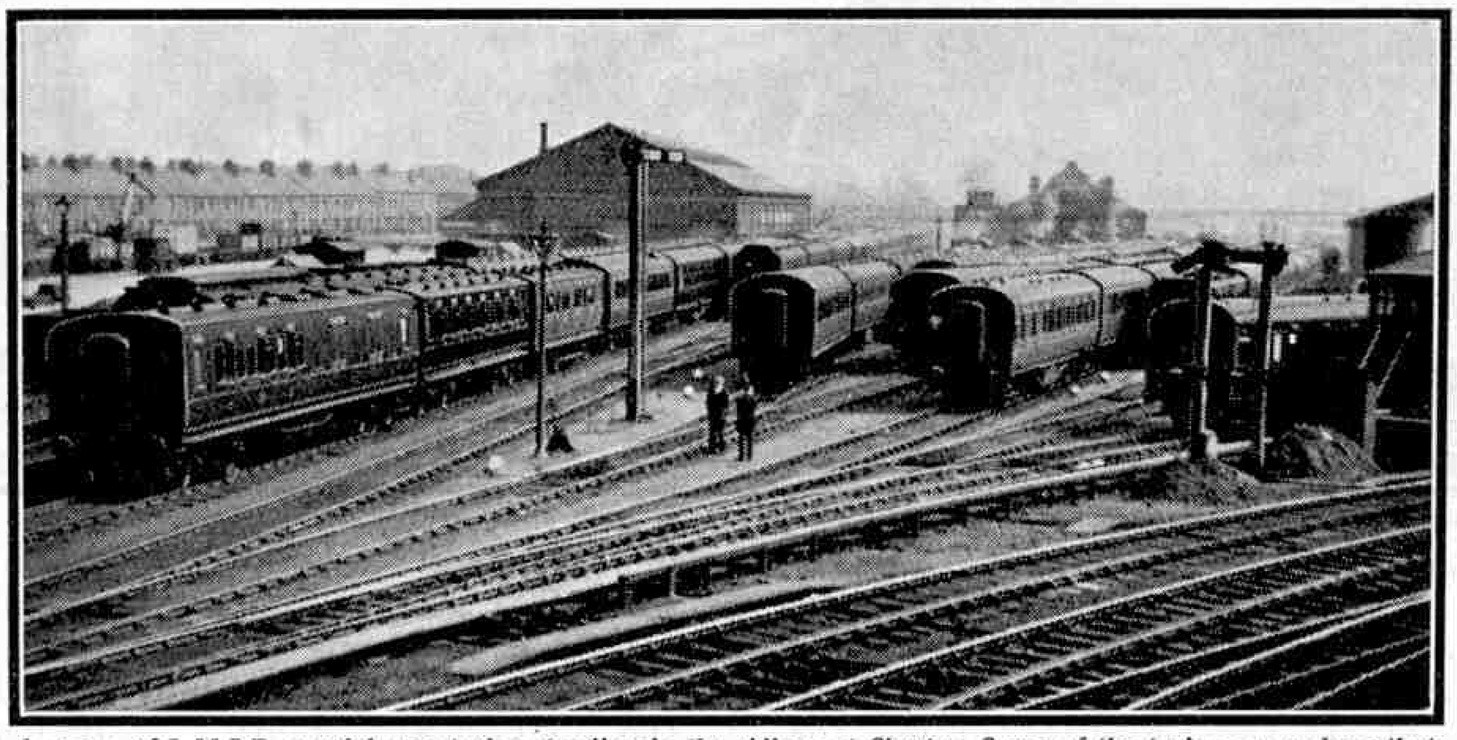
Special Trains for Passengers and Goods

Control Problems Involved

By E. S. P. Rawstron

ONE of the most noticeable features of the back-to-prosperity campaign of British railways has been the great increase in the number of special trains run at excursion and ordinary fares. This type of traffic has become so heavy that it has called into being a specialised branch of railway operation.

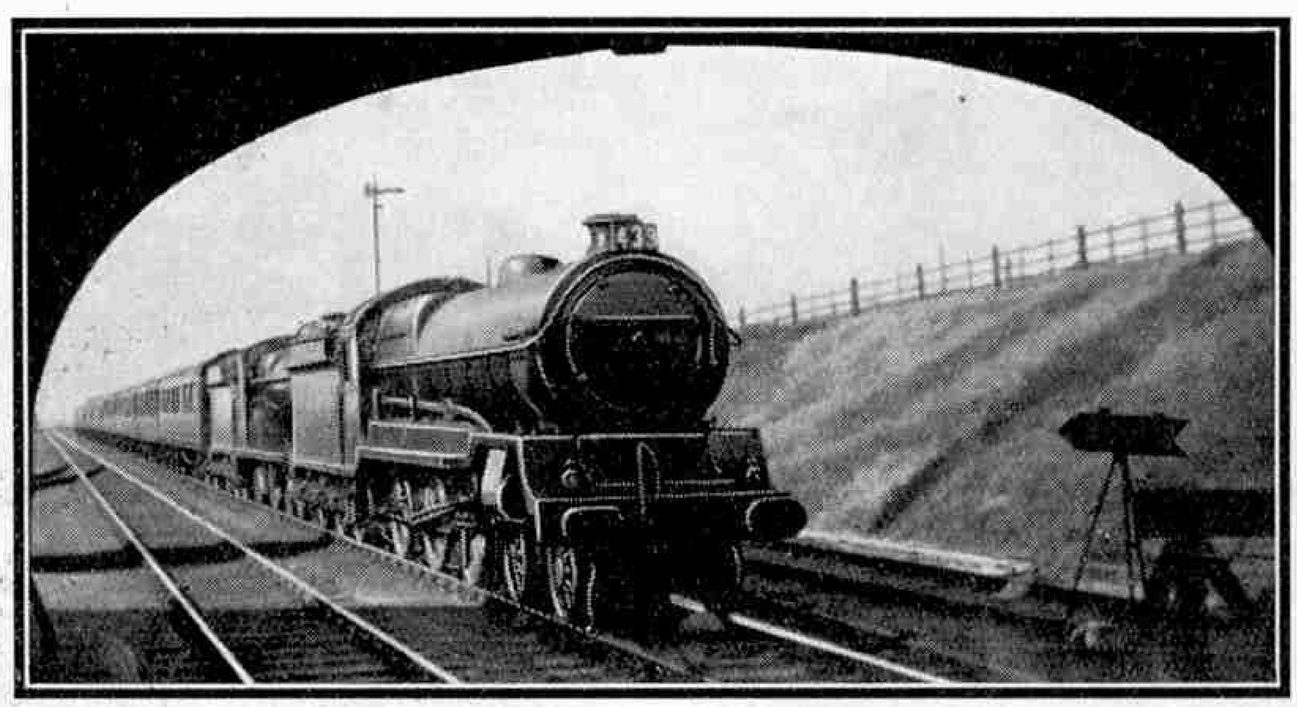
The purpose of special trains is to provide convenient travel facilities for holiday occasions, race meetings, sports events and many kinds of public function. In making arrangements for these extra trains to be run, the first step lies in finding room for them in the timetables, and in devising a schedule of stopping and passing times such that they do not interfere with the regular traffic. Rearrangement or cancellation of regular trains is only permissible when the special traffic is likely to be intense, and it is then necessary to give due warning to the travelling public of the changes made in order to prevent disappointment and confusion.



A group of L.M.S.R. special race trains standing in the sidings at Chester. Some of the trains are so long that they have to be divided into two sections.

Following these adjustments, advertisements and handbills have to be made out for the use of the public, and a supply of leaflets printed for workers on the railway. The railwaymen's leaflets contain detailed information regarding the timing, destination and haulage of every special train due to run during a particular week or fortnight. This intelligence is invaluable to signalmen, locomotive men, station staffs and the heads of controlling offices.

When an inrush of trains on one city or holiday resort is planned, additional instruction given to the local staffs shows the station platform to which each train must be directed, where it must be stabled, where and when the locomotives must be turned and made ready for the return journey, and from what platforms the return specials must depart. Directions are prepared also for the use of the heads of the auxiliary staffs who are drafted into the area for the occasion, and for the use of the engineer in his task of constructing fences, erecting noticeboards, providing extra lamps, and setting in order disused tracks and platforms, all in preparation for the travellers' invasion.



An L.N.E.R. race special approaching Aintree from Newmarket. The special train number "439" carried on the leading engine, and also on the end vehicle, enables signalmen and others to identify the train and deal with it according to the instructions previously issued.

The handling of the locomotives alone is an intricate and sometimes difficult task. Complications arise from the fact that a large proportion of excursion and other special trains follow routes over which through services are normally not in operation. In providing engines for these through trains, the foremen at the running sheds have to be very careful to see that no engine is detailed to work over stretches of line where underbridges are not strong enough to bear its weight, or where tunnels and over-bridges are too low to allow of safe passage beneath. On some lines, also, big engines are not allowed to run on account of the existence of turntables too small to accommodate them and curves too sharp for them to take.

It is not surprising to learn, therefore, that a great amount of information relating to the nature of the track and the exact size and weight of every engine in service is at the disposal of the locomotive superintendents. These experts have to know precisely which classes of engines are restricted from working over certain sections of line, at what maximum speeds other classes may traverse particular bridges, and other similar matters.

A vital point in the working of long-distance special trains is the provision of a third man whose duty it is to travel on the footplate with the driver and fireman. It is essential for a driver working over new ground to be accompanied by this third man or "pilot," as he is called, for the safe running of the train depends on his perfect knowledge of the route, and on the orders that he gives to the driver at different points as the miles fly by.

A severe problem in locomotive management occurs on occasions such as the Association Cup Final and the Grand National, when a great many locomotives converge upon one spot. At Aintree, on Grand National Day, for example, 90 locomotives annually arrive at the head of 60 long-distance specials. These engines—which include everything from a Gresley "Pacific" to a Pollitt 4–4–0 of the L.N.E.R., and from a Hughes 4–6–0 to a Lancashire and Yorkshire 0–6–0 of the L.M.S.R.—all have to be turned, supplied with water, and sometimes coal, and allotted to their correct return specials in particular sidings within the three to five hours intervening between the arrival and departure of the race trains. In the vicinity of Aintree there are, fortunately, extensive sidings, two engine sheds, two turntables and a triangular junction, the last of which enables locomotives of the largest size to be turned without difficulty. Even with these conveniences, however, the successful handling of the engines and the marshalling of the trains, without interference to other traffic, is an intricate matter.

To popularise their services, the railways from time to time organise specials of an attractive and original character. During the early summer, for instance, it is now becoming the custom to provide a number of trains whose purpose is to carry prospective visitors on a day's tour to a group of holiday resorts. This enables people to see the country "on approval," as it were, before deciding upon a particular resort for their holidays.

A novel type of excursion train was tried out with great success by the G.W.R. at Eastertide in 1932. The "Hikers' Mystery Express," as it was called, was arranged to set out from Paddington in a morning to destinations unknown to the passengers, driver and

guard, until after the train had started. On reaching country ground, the train stopped to set down in districts suitable for rambling, where time was given for a long "hike" before the return journey to Paddington was made in the evening.

The *"Northern Belle"* Cruising Train of the L.N.E.R. may be quoted as an example of a special train requiring an unusual amount of forethought and organisation as regards catering. During its week-long trip, the *"Northern Belle"* has to be cleaned and watered all over the country, and supplied with fresh food and linen daily. Road sight-seeing trips and hotel festivities also have to be planned for the entertainment of the 60 tourists, who require a staff of 27 men and women to look after them.

The Royal Train stands supreme with respect to the care it receives to ensure its safe running over every mile of ground it covers. In addition to the special directions describing the safety precautions to be taken in connection with the running of the train, a miniature working timetable is issued for the personal instruction of each railwayman concerned when the King and Queen travel. This timetable shows the timing of the Royal Train throughout, from the moment when the locomotive leaves the engine depot to collect the empty train to the corresponding moment when it is once more installed beneath the shed roof at the end of its return journey. Passing times are shown every three miles or so, which assists in the punctual timing of the train.

The four or more saloons, the equipment car and brake van, that comprise the usual formation of the Royal Train, are arranged in a particular order before setting out, and this order has to be accurately reversed before commencement of the return journey. Among other details provided in the timetable are special notices for signalmen, stating which trains the Royal special must precede along the lines, and what particular bell code is to be used to signal its approach. Similarly, the engine crew are at times required to observe such things as: "On arrival at X—— the engine of this Special is to be stopped short of the station platform, with the footplate opposite to the Station Master, who will be on the ground." Such a note as this would refer to a small ceremony to be performed by the Station Master in honour of the occasion.

Turning now to the goods side, the regular freight services provided by the railways have to be supplemented by specials in the same way as passenger services. The goods specials have to cope with agricultural produce, livestock, inrushes of shipping cargoes, such unusual consignments as bridge girders, electrical transformers, locomotives, ships' rudders, travelling circuses, and so on. The operating staffs responsible for these trains are usually free from the problems of station control, food supplies, and other factors attending the handling of large passenger crowds, but these difficulties are replaced by others equally great.

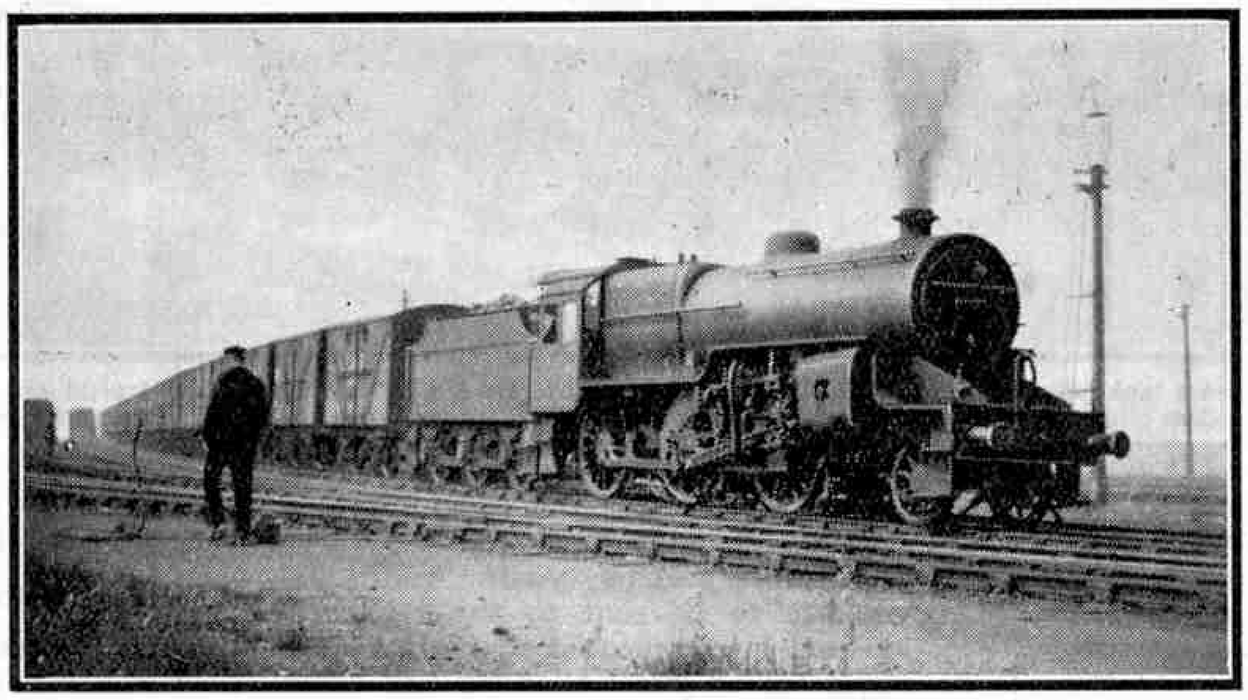
An example will be found in the well-known banana traffic dealt with at Garston on the River Mersey. The Fyffes Line banana vessels dock at this port once a week in winter, and once or twice a week from May to September. Thirty-one special trains, with an average length of 25 wagons, are required for the removal of the cargoes of bananas carried by the bigger steamers. The work of transferring the fruit from ship to train, a matter for which the L.M.S.R. are responsible, occupies one-and-a-half days.

In 1932, which proved a normal year for the banana trade, 65 banana boats docked at Garston. From these vessels a total of 6,367,096 bunches of bananas, weighing 104,587 tons, was despatched by approximately 40,125 banana vans made up to 1,625 L.M.S.R. trains. The principal districts served each year by these specials are London, Birmingham and the Midlands, Northern England and Scotland. If two steamers arrive in a week, additional consignments are conveyed to counties south of London. The banana plantations from which the Garston fruit is drawn lie in Jamaica and Central America.

The unloading and loading operations at Garston are carried out briefly as follows. The banana wharf is equipped with four sets of electrically-operated elevators and endless belt conveyors. Each elevator consists of an endless chain, spaced at equal distances with canvas trays, which travels up from the ship's hold, over the ship's side and on to the quay. Here the fruit is discharged from the trays on to a horizontal endless belt conveyor, and as this moves along, the bunches of bananas are lifted clear by porters and placed in the railway vans waiting alongside. With the machinery in full operation, at all four of the steamer's hatchways, the fruit can be unloaded from the ship and transferred into the wagons at the rate of approximately 1,000 bananas a second.

An interesting view of the special plant for unloading bananas at Garston docks. This takes the form of an endless belt conveyor that can be moved along on wheels to suit the position of the ship that is being unloaded. Photograph by courtesy of the L.M.S.R.

Every one of the 600 or more vans used in the unloading of each vessel is twice drawn over the weighing machine by hand-operated capstans. The wagons are first weighed tare, containing packing straw alone, and again with a full complement of bananas; and in this way the total tonnage of fruit conveyed is deduced. In order to keep the bananas in as clean a condition as possible, none of the straw supplied for padding the floor and walls of the vans is used twice, fresh straw being supplied for every new load. In view of the importance of keeping bananas in an even, warm temperature, the fruit vans are steam heated during the winter months. The precautions taken are such that, even during the brief space of time intervening between the loading of the vans and the coupling up of the train engine, the wagons are heated by steam supplied from a stationary boiler.

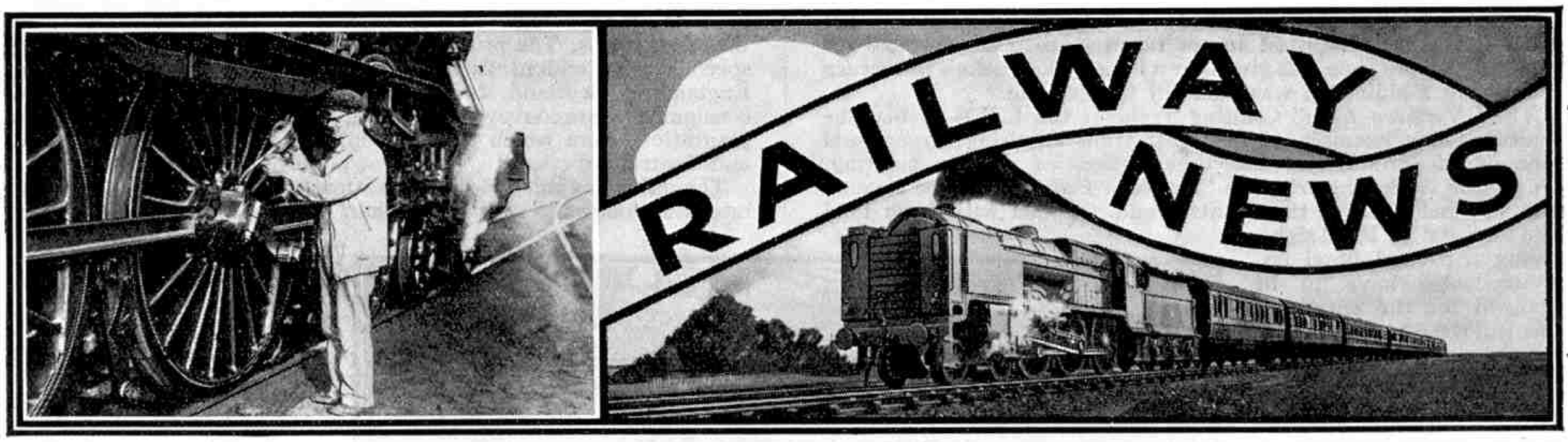


A special train of bananas leaving Garston for Carlisle. The engine is No. 13082, of the original standard design with domed boiler and inclined cylinders.

Special facilities and trains are provided by the railways for the conveyance of fish, flowers, vegetables, meat and general foodstuffs. The method of dealing with vans carrying flowers and vegetables is often to attach them to passenger trains, thus ensuring the fast delivery that these perishable commodities demand. To cope with the huge deliveries of fish that are associated with such ports as Grimsby, Aberdeen, Hull and Fleetwood, however, trains consisting wholly of fish vans have to be made up. During Easter Holy Week, when the demand of the market is particularly large, a dozen or more train loads of fish may be despatched from a port like Grimsby on a single day. Here, each year, 200,000 tons of fish are landed, for rapid transport to the important markets of Sheffield, Manchester, Liverpool, Leeds, Nottingham, Birmingham, London (Billingsgate) and the South.

Under the heading of "livestock," a great many horse-box trains form a further important branch of special traffic. These specials are run chiefly in connection with the race meetings already mentioned in this article, though horse sales also attract a large amount of traffic. During September race week at Doncaster, for instance, where horse sales are held on a large scale, 1,400 horses are annually brought in some 70 long-distance special trains, consisting of over 1,000 horse-boxes.

The railway companies likewise undertake the carriage of homing pigeons from one part of the country to another, feeding them at appointed times and liberating them at their destinations. Horse and pigeon trains travel at passenger *(Continued on page 186)*



L.N.E.R. Renewal Programme

The renewal programme of the L.N.E.R. for the present year is a very big one, and when carried through will improve considerably the Company's stock of locomotives, carriages and wagons. The number of locomotives to be built is 88, comprising 39 freight engines of the 0–6–0 "J39" class, 35 "Moguls" of the "K3" class, and 14 engines of a new class specially designed for heavy long distance work. No definite information regarding the engines of the new class has been published, but it is rumoured that they will have the 2–6–2 or "Prairie" wheel arrangement.

Passenger rolling stock is to be improved by the building of a total of 315 carriages, including four sleeping cars, 10 restaurant and buffet cars, and two complete "tourist-train" sets. Four train sets for the Great Eastern suburban service also will be built, and these will replace some of the old-fashioned double-compartment carriages, in which passengers in one compartment can look over at those in the next, that have been in use on the Great Eastern section for many years.

About 5,000 goods wagons and brake vans are to be built, including 1,580 wagons of the open 12-ton type and 2,200 of the covered 12-ton type, all fitted with vacuum brakes. Special types of wagons included in the programme comprise 75 wagons of 20 tons capacity for the conveyance of tubes, 500 fish wagons, and 100 all-steel 20-ton wagons for the conveyance of locomotive coal.

The programme also includes the relaying of 436 miles of permanent way, the renewal of 37 bridges, and the cleaning and painting of certain stations, some of which will have special colour schemes in their decoration.

S.R. 0-4-4 tank locomotive No. 1553. This former South Eastern & Chatham engine is a typical example of the class long used on London suburban trains and displaced on the introduction of "Southern Electric" services. They are now used for less strenuous duties in country districts.

Locomotive Activities on the L.M.S.R.

Derby works have completed the order for 10 "5X" three-cylinder 4–6–0 type express locomotives with tapered boilers and to these the numbers 5655 to 5664 have been given. Contractors have supplied further engines of this class up to No. 5597.

The whole of the 50 new two-cylinder mixed-traffic 4–6–0 locomotives are now at work and are allocated as follows: Nos. 5020-9, Northern Division; Nos. 5030-1 and 5053-8, Midland Division; Nos. 5032-52 and 5059, Western Division; and Nos. 5060-9, Central Division. In addition, 20 further engines of this class, to be numbered 5000-19, are at present in hand at Crewe. The 155 engines of this type provided for in the 1935 programme will be built as follows: Nos. 5070-4 at Crewe; Nos. 5075-5124 by the Vulcan Foundry Ltd.; and Nos. 5125-5224 by Sir W. G. Armstrong, Whitworth and Co. Ltd. It is anticipated that there will be a considerable increase in the use of these mixed-traffic engines on the Northern Division during this year. Additional engines are to be sent to the Highland section and it is expected that others will be employed on the Callander and Oban line.

A large influx of the Stanier three-cylinder engines of the "5X" class is taking place in the Midland Division. These engines have now been entirely withdrawn from the Birmingham Two-Hour expresses, now again worked by "Baby Scots" and Compounds, and the Stanier engines apparently are required for the hardest Midland trains such as the "*Thames–Forth Express*," which is now often worked through from St. Pancras to Leeds by one of these engines.

Re-boilered "Claughtons" Nos. 5993, 5999 and 6004, previously shedded at Crewe and Rugby, have been allocated to Northampton shed.

Recent withdrawals include three more "Claughtons" Nos. 5904, 5914 and 6019; 13 "Princes"; and No. 764, one of the Midland Class 3 4–4–0's. The 0–4–0 tank engine No. 11255 has been sold.

Southern Railway Improvements at Waterloo

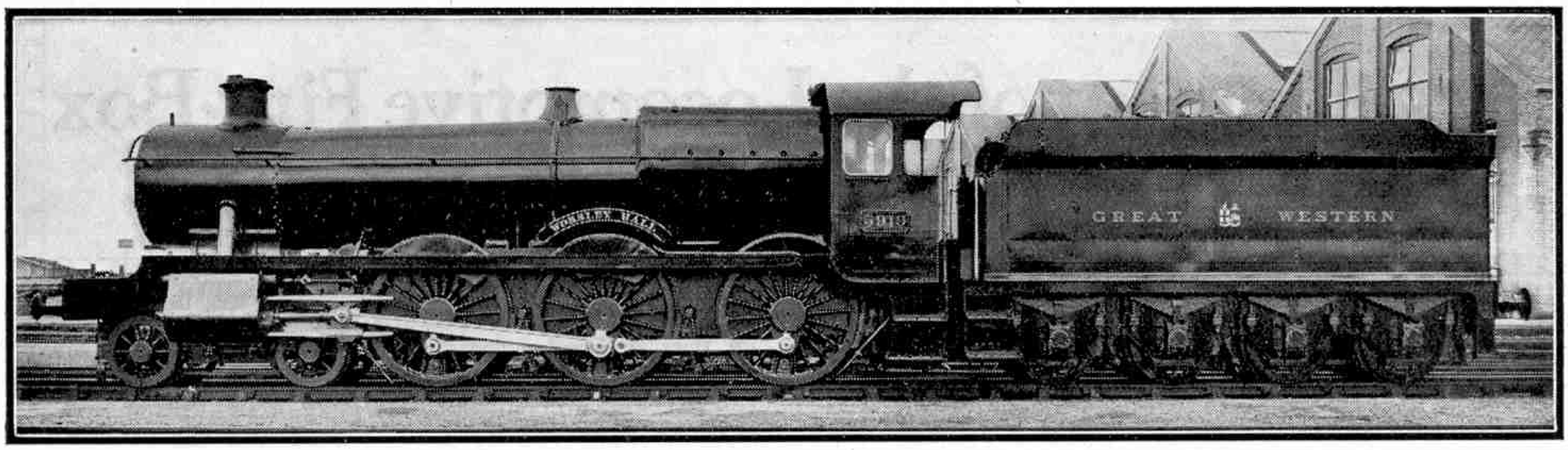
The Southern Railway are going to carry through a big scheme for facilitating the movement of trains into and out of Waterloo terminus. This will cost about £500,000.

The new scheme provides for the construction of a flying junction near Durnsford Road, Wimbledon. This will enable a transposition of lines to be made between Wimbledon and Waterloo, the effect of which will be that trains from Kingston, Hampton Court, etc., will be taken from the present up lines over to the present down lines, giving direct access to their respective platforms at Waterloo. The cross-overs at present used will be avoided and the main track will be released for occupation by main line and other trains.

An important part of the scheme will be the installation of the 3-aspect colour-light signalling between Waterloo and Hampton Court Junction, permitting trains to run at intervals of from 2 min. to 2½ min., as compared with the present margin of 4 min.

Freight Flyers on the L.M.S.R.

As a result of further speeding-up, the L.M.S.R. now operate 18 "freight flyers" whose average speeds, over distances varying from 155 miles to 541½ miles, range from 36 m.p.h. to 44 m.p.h. The fastest train is the 10.45 p.m. from Carlisle to London (Camden), which covers the 297¼ miles in 405 min., exclusive of stops, at an average speed of 44 m.p.h. The longest through journey is that of the 9.45 a.m. from Aberdeen to London (Broad Street), which covers the 541½ miles at an average speed of 42.7 m.p.h., while the longest run without a stop is by the 7.45 p.m. from London (Camden) to Liverpool (Edge Hill), 191 miles at 39 m.p.h. Freight from Ireland is carried swiftly to London by a train that does the 268¼ miles from Holyhead to Broad Street at an average speed of 40.3 m.p.h.



Speeding on the L.M.S.R.

An exceptionally fast run was made recently by the up *"Royal Scot"* express on the L.M.S.R. The train consisted of 13 coaches, weighing 443 tons, and was hauled by the 4–6–2 locomotive *"The Princess Royal."* After a special stop at Bletchley to take water the 46¾ miles to Euston were covered in 46 min., inclusive of two min. delay by signals. An average speed of 78.9 m.p.h. was maintained over the 26¼ miles between Tring and Willesden. The driver was L. A. Earl of the Camden depot.

Another sparkling performance was accomplished by the "Baby Scot" No. 5532, *"Illustrious,"* which has lately returned from the Midland to the Western Division. Working the 4.35 p.m. Birmingham and Stafford express from Euston, with a load of 295 tons tare, Willesden (5.4 miles) was passed in 8½ min., Watford (17.4 miles) in 20 min. Tring (31.7 miles) in 33¼ min., Bletchley (46.7 miles) in 45 min., and Wolverton (52.4 miles) in 49½ min. A signal check ensued at Castlethorpe, but the 62.8 miles from Euston to the stop at Blisworth were covered in 61 min. 39 sec. The maximum speed was 82 m.p.h. near Cheddington. Driver Grazier and Fireman Lawrence of Bushbury Shed were in charge.

Streamlining Steam Locomotives

In view of the advantages that evidently accrue from streamlining, many more streamlined trains are being built for use on the Continent of Europe and in America. In addition, experiments in the streamlining of steam locomotives are being carried out, particularly in Germany and the United States. On the New York Central Lines a standard 4–6–4 express locomotive, the *"Commodore Vanderbilt,"* has been covered with a streamlined cowling shaped to offer the least possible resistance at high speeds. The casing is brought as near to rail level as is feasible, and is cut away over the coupled wheels to allow access to the running gear.

G.W.R. Locomotive News

Additional particulars are now available of the 95 new locomotives to be built by the G.W.R. during 1935. As stated last month, 10 more of the splendid 4–6–0 express engines of the "Castle" class and 15 of the useful 4–6–0s of the "Hall" class are to be constructed, and the programme also includes 10 of the standard 0–6–0 goods locomotives of the 2251 class. The remaining 60 new engines will be 0–6–0 tank locomotives, comprising 50 of the "57" class, five of the "64" class, with 4 ft. 7½ in. wheels, and five of the "54" class with 5 ft. 2 in. wheels. The 10 engines of the "64" and "54" classes will be equipped for working auto-trains.

Among the engines recently condemned are various locomotives of the subsidiary Welsh lines. Those of G.W.R. origin include Nos. 2222, 2225, and 2239 of the 4–4–2 "County Tank" class, and Nos. 2624 and 2647 of the 2–6–0 "Aberdare" class with inside cylinders, and No. 3387 of the useful "Bulldog" 4–4–0 class.

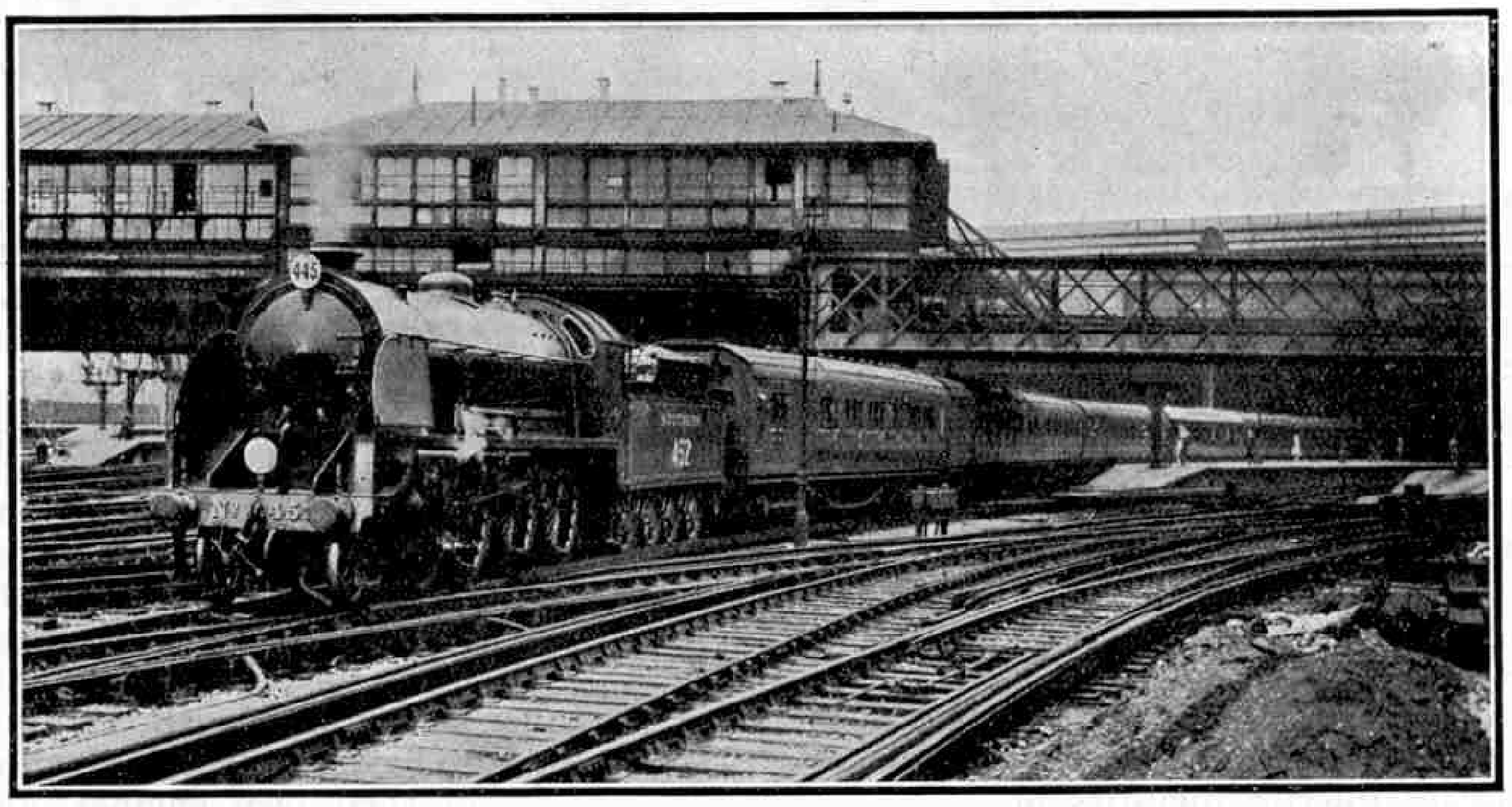
A New System of Railway Signals

The L.N.E.R. are to make an experiment with an entirely new system of signals on the branch line between Pilmoor Junction and Knaresborough. This line is a single track about 12 miles in length, with passing places at the three stations it serves. Telephonic communication between the stations is to be retained and the "staff and ticket" method of working the single line will be continued, but the familiar semaphore signals are to be replaced by signal boards that will serve to give various indications to drivers.

A "location" board will be substituted for the distant signal. This board is rectangular in shape and is painted black and yellow in diagonal stripes. It is large and will be seen easily in daylight, and at night a zig-zag row of hemispherical reflectors will be readily visible, as they will be illuminated by powerful electric headlamps on the engines.

The conventional home signal is to be replaced by an even larger board fixed vertically at a suitable height. This is painted red and white in diagonal stripes, with white reflectors and three red clusters down the centre. The station board is 4 ft. square and is fitted on the platform. If a train can be received in the day time, the official in charge of the station lifts up a flap on it to exhibit a green centre, and at night a green light is made visible in the same manner. The points will be controlled by the "train staff" for the section concerned, and shunting movements will be carried out by the train crew.

The service on this branch line is light and the section therefore is suitable for experimenting with the new system. If this is successful, its extension to other branch lines will be considered.



The upper illustration shows G.W.R. 4-6-0 locomotive No. 5919, "Worsley Hall," with an experimental eight-wheeled tender. Photograph by courtesy of the G.W.R. In the lower illustration, reproduced by permission of the "Southern Railway Magazine," S.R. locomotive No. 452, "Sir Meliagrance," is seen leaving Waterloo with a West of England express.

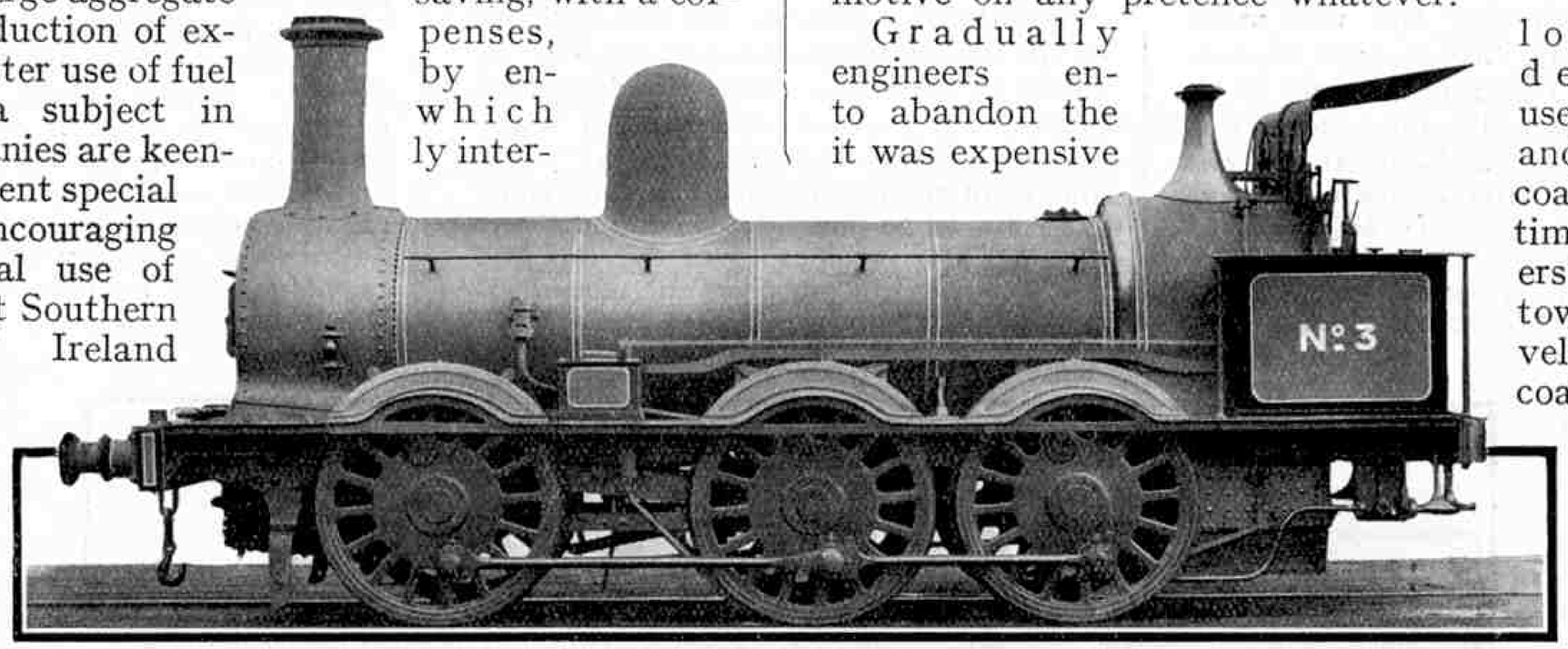
Washing a Train in Two Minutes

It takes only two minutes to wash a train by means of the electrically driven appliances now being installed by the S.R. at Selhurst, Orpington, Slades Green and Clapham Junction. In the machine in use at these depots there are four upright shafts on each side of the track in a steel frame building. The shafts are rotated and strips of cloth on them fly outward and gently lap the sides of the coaches to be cleaned, removing all traces of dirt with the aid of copious showers of water sprayed on the cloths from vertical and horizontal pipes. The plant is controlled from a small cabin near the machine.

Development of the Locomotive Fire-Box

Fuelling and Combustion

THERE are over 20,000 steam locomotives in railway service in this country, and in the course of a year they run some 531,000,000 miles. Taking the consumption of an express engine as two tons of coal for each 100 miles covered, the total amount of fuel used reaches very large figures. A small saving on each mile covered would mean a very large aggregate saving, with a corresponding reduction of expenses, so that the better use of fuel by engineers is a subject in which railway companies are keenly interested. In a recent special publication encouraging the economical use of coal, the Great Southern Railways of Ireland point out that roughly half the cost of the Locomotive Running Department is accounted for by the purchase of coal. Since the earliest days economy in fuel has been sought after, and many and various are the devices that have been conceived with this end in view. In this article we propose to deal briefly with some of the developments in this direction that have affected the locomotive fire-box, and its fuelling.



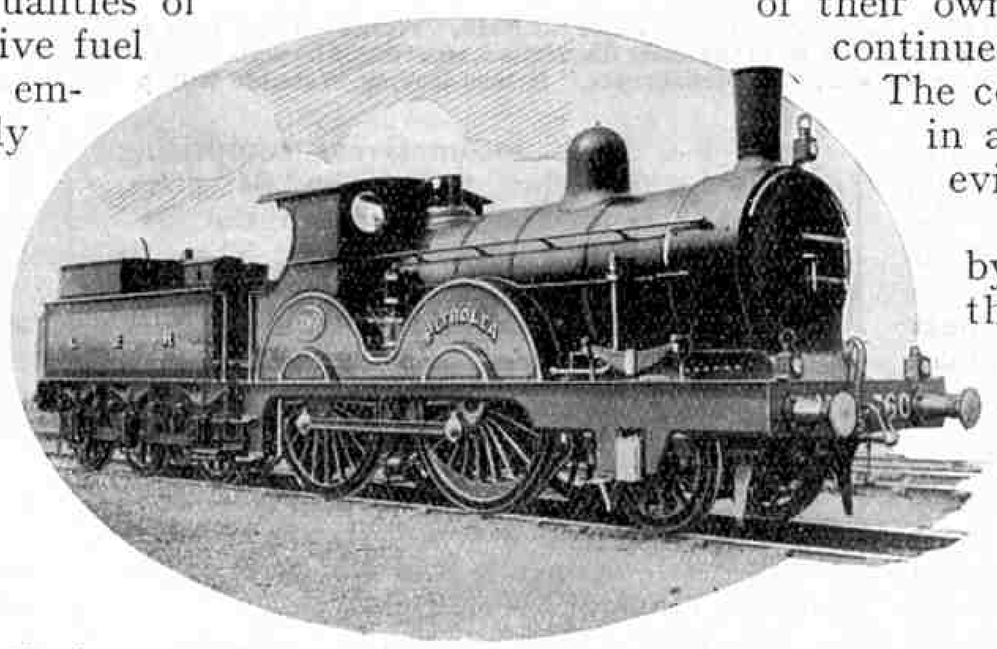
An old locomotive constructed on the "long boiler" plan of Robert Stephenson. This involved the placing of all the axles under the boiler barrel and, while having certain advantages, prevented the use of a fire-box of any great size.

British coal is of excellent quality, and no railway in this country is really situated far from a source of suitable supplies. Abroad, however, different conditions obtain, with the result that specially arranged fire-boxes are in use, suitable for inferior qualities of coal. Oil is also used as a locomotive fuel where it is obtainable. Wood is employed to some extent if readily available where coal and oil are scarce, and therefore dear.

In the early days of locomotives coke was generally used as a fuel, for the crude draught and fire-box arrangements did not allow of the combustion of coal without the emission of a considerable amount of smoke. The use of coke was even laid down by Statute in several cases, no doubt as a result of the widespread belief that the fumes from the "locomotive engines" would pollute the atmosphere to such an extent that wholesale mortality would result among livestock, not to mention human beings! The following restrictions with regard to fuel, which were laid down when the Warrington and Newton Railway was authorised, will illustrate this point.

"Every locomotive steam engine used within the parishes of Burtonwood and Winwick shall be constructed on best principles for enabling it to consume its own smoke and preventing noise in the machinery or motion thereof, and no coal, but only coke or such other fuel as shall be approved by Lord Lilford and the Rector of Winwick, shall be used or consumed on such locomotive on any pretence whatever."

Gradually locomotive engineers endeavoured to abandon the use of coke, for it was expensive and inferior to coal. Three old-time experimenters who did much towards the development of coal-burning fire-boxes were Beattie, McConnell and Cudworth, heads of locomotive matters on the L.S.W.R., L.N.W.R., and S.E.R., respectively. Each of them produced "patent fire-boxes" that were somewhat extensively applied on their own lines, but these special forms were superseded, and indeed rendered unnecessary, by subsequent developments. Actually the Beattie and Cudworth systems were the subject of comparative trials, engines of each company taking a turn for a period of two months in working the chief expresses of the other in company with the "home guard." Both sides appear to have been satisfied with the performances of their own engines, and both engineers continued to follow up their own ideas. The comparative value of the trials in a scientific sense was therefore evidently very small.

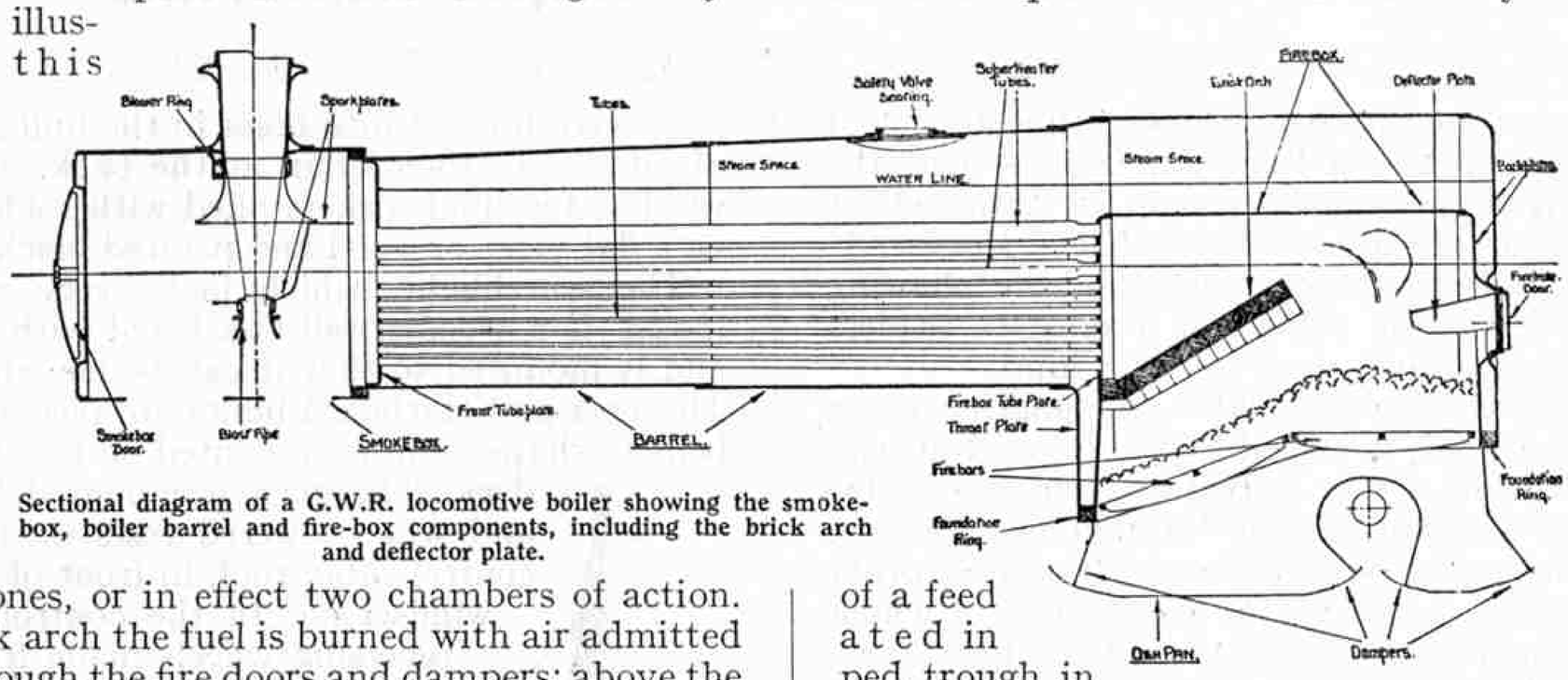


The famous locomotive No. 760, "Petrolea," one of the G.E.R. engines fitted for oil burning on the Holden system.

Of the forms of fire-box evolved by the three engineers in question, the McConnell type involved the use of a combustion chamber extended into the boiler barrel. Both the Beattie and the Cudworth types were more or less complicated, and the Beattie fire-box at first was used in conjunction with a combustion chamber partly filled with perforated firebricks. Eventually this arrangement was given up, but the special fire-box remained. It is curious in that it consisted of two chambers, one behind the other, separated by a water space or "bridge," and each with its own firehole. The coal was mostly fired into the rear chamber, and the smoke and unburnt gasses passed from this into the front chamber, where the fire was maintained in an

incandescent state, and so combustion was completed.

The Cudworth fire-box also was divided, but in this case the division was longitudinal. Two fireholes were again necessary, and the usual plan was to fire these alternately. The numerous joints necessitated by both of these special constructions must have given a great deal of trouble in repair and maintenance generally.



Sectional diagram of a G.W.R. locomotive boiler showing the smoke-box, boiler barrel and fire-box components, including the brick arch and deflector plate.

The upper illustration on this page shows the various components of the fire-box and boiler generally of a modern locomotive. It will be observed how the brick arch gives the fire-box two zones, or in effect two chambers of action. Below the brick arch the fuel is burned with air admitted from below through the fire doors and dampers; above the arch the gases and smoke are consumed with the air drawn through the firehole. The function of the deflector plate is to prevent the cold air that enters through the firehole from bearing straight on to the tube-plate. It will be realised, therefore, that the effects aimed at by the early experimenters are obtained with far more simple equipment and with less initial expense and subsequent maintenance. The introduction of a brick arch took place on the Midland Railway in 1858, and did away with the need for the special forms of coal-burning fire-boxes, although these persisted for some time afterwards on their own systems.

In this country it is the usual practice to use a fairly long, but narrow and deep, fire-box for burning the bituminous coals of good quality that are usually considered essential for locomotive purposes here. Exceptions to this are the "Pacific" and large "Atlantic" locomotives of Doncaster design running on the L.N.E.R., the similar "Atlantics" of the S.R., and of course the L.M.S.R. 4–6–2 locomotives. The small trailing wheels of all these engines facilitate the adoption of the wide fire-box spread across the frames. It is noteworthy, however, that all the other "Atlantics" on British railways have narrow fire-boxes, in spite of the opportunity provided by the wheel arrangement for the incorporation of a wide one. The former "Atlantics" of the G.W.R. also followed this practice, but as these were an adaptation of the original Swindon 4–6–0 design, and there was the possibility of their ultimate conversion to the latter type, this no doubt accounted for the use of the standard boiler and fire-box. The steaming qualities of the Doncaster "Atlantics" and "Pacifics" have always been remarkable, and there is little doubt that the large fire-boxes have much to do with this. They are able to burn efficiently quite small and even dusty coal. A wide fire-box is used also on the L.N.E.R. 2–8–2 freight engines, and on the latest passenger engines of the same wheel arrangement, such as the famous *"Cock o' The North."*

With the increase in the size and power of locomotives made necessary by higher speeds and heavier loads, the work of the fireman has not diminished. Abroad, particularly in America, the vast fire-boxes in use demand more than man power for their satisfactory fuelling, with the result that numerous designs of mechanical stokers have been produced. These are not robots made to handle the shovel at abnormal firing rates, but consist primarily of a feed screw situated in an open-topped trough in the bottom of the coal space. As the screw is revolved the coal is fed forward below the cab floor, through a feed tube, up and into the fire-box. Special distributors enable the grate to be covered as necessary.

Such fittings are not yet apparently considered necessary on British railways, although as long ago as 1904 the G.W.R. were experimenting with a mechanical stoker. However, on the "Garratt" type of locomotive used for specially heavy coal and mineral services on the L.M.S.R., the opportunity has been taken of relieving the fireman of any of the coal-trimming frequently involved on a continuous steaming trip of any great length. This is effected by the use of a patent self-trimming coal bunker devised by Beyer, Peacock and Co. Ltd., whose name is specially associated with "Garratt" type engines. This mechanical coal trimmer takes the shape of a large cylinder mounted where a rectangular coal bunker would normally be. It is made to taper slightly outward from back to front, and its axis is inclined so that the top of the bunker is horizontal. The bottom therefore slopes downward to the cab. It is supported by suitable bearings; and can be revolved through gearing by means of two small stationary engines controlled from the cab. The bunker has doors on top for coaling purposes, but these are ordinarily kept shut. Thus as the bunker is revolved the coal is fed down to the shovel plate, whence the fireman transfers it to the fire-box.

One of the L.M.S.R. "Beyer-Garratt" locomotives fitted with the patent Self Trimming Bunker evolved by Beyer, Peacock and Co. Ltd.

This bunker can be revolved in less than half a minute, if required, and its use in between spells of firing avoids additional labour on the part of the fireman in getting coal forward. The loss of coal and the overloading caused by piling up the fuel in an ordinary tender is made impossible. In addition the coal is completely protected from the weather, which is a matter of more importance than is generally realised.

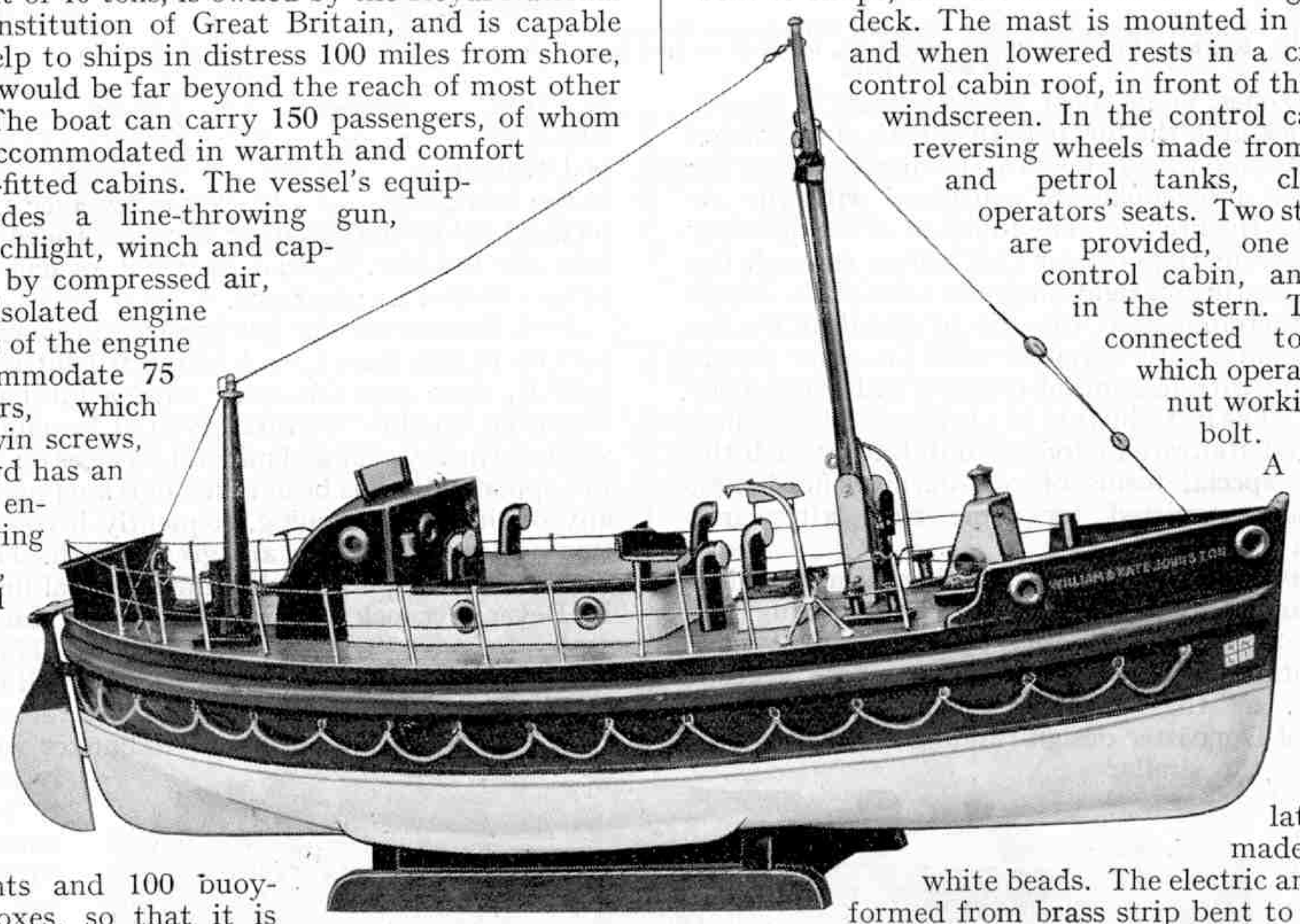
The burning of pulverised fuel in *(Continued on page 144)*

An Interesting Life-Boat Model

Realistic Results from Simple Materials

THE illustration on this page shows a fine model of one of the largest motor life-boats in existence, the "*William and Kate Johnston*," which is stationed at New Brighton near the mouth of the River Mersey. It was built by Mr. E. Vidler, of Liverpool, and the following details of its construction will be of interest to readers who appreciate miniature work of this kind.

The actual vessel, which is 60 ft. in length with a displacement of 40 tons, is owned by the Royal National Life-Boat Institution of Great Britain, and is capable of taking help to ships in distress 100 miles from shore, where they would be far beyond the reach of most other life-boats. The boat can carry 150 passengers, of whom 50 can be accommodated in warmth and comfort in two well-fitted cabins. The vessel's equipment includes a line-throwing gun, electric searchlight, winch and capstan driven by compressed air, and three isolated engine rooms. Two of the engine rooms accommodate 75 h.p. motors, which drive the twin screws, and the third has an auxiliary engine for driving a dynamo, pump and air compressor. The boat is fitted also with 11 transverse watertight compartments and 100 buoyancy air boxes, so that it is practically unsinkable.



A fine working model of a motor life-boat, built by Mr. E. Vidler, Liverpool, from simple and easily obtained materials.

The model is built as far as possible to scale and its dimensions are length 20 in., beam 5 in., and depth 4 in. The cost of building the boat was under 10 shillings, the majority of the fittings being made at home from very simple materials.

The hull is a beautiful piece of work, and was carved out of a solid block of yellow pine. It is provided with two watertight compartments. Power is supplied by a Hornby Speed Boat Motor connected to twin propellers through Meccano bevel gearing, and the propeller shafts are enclosed in miniature tunnels fitted with packed glands.

The deck fittings, which include bollards, electric winch, mast and tabernacle, searchlight, anchor davits, port and starboard lights, ventilators, samson posts, hatches, control cabin, and steering box, are all home-made from odds and ends of the kind found in most houses. The ports in the cabins and the engine rooms are $\frac{3}{8}$ in. dia. brass eyelets such as are used in sail making, and they were pressed into holes in the hull and small pieces of mica were then let in at the back. The bollards are wireless terminal sockets filled with solder and mounted on a flat piece of wood and painted black.

The searchlight, which looks very effective in the model, is a wooden pill-box fitted with a small mirror, and is mounted so that it can be elevated and rotated. The port and starboard lights are pieces of copper strip bent to shape, and are mounted on two legs fixed in the deck. The mast is mounted in a tabernacle, and when lowered rests in a crutch on the control cabin roof, in front of the helmsman's windscreen. In the control cabin are two reversing wheels made from clock parts, and petrol tanks, clutches, and operators' seats. Two steering wheels are provided, one aft of the control cabin, and the other in the stern. The latter is connected to the tiller, which operates through a nut working on a small bolt.

A wireless mast is situated on the starboard side of the stern cabin hatch, and is complete with aerial and insulators, the latter being made from small white beads. The electric anchor winch is formed from brass strip bent to shape, and is screwed to a wooden base. An old watch provided the gears, and the winch drums were turned on a home-made lathe and then painted in appropriate colours.

Long pins hammered into the deck and bound with strong white thread held in position with Croid glue, make realistic stanchions, and the two anchor davits are short pieces of copper wire bent and flattened at the ends to take a small hole, which was punched with a gramophone needle. The blocks on the forestay and mast were cut from a strip of yellow pine, the holes being made before the blocks were cut to shape so as to prevent the wood from splitting. Engine exhaust pipes are fitted on both sides of hull, and a hand life-line extends completely round the hull, as is the usual custom in lifeboats.

A piece of photographic film was used to make the windscreen on the control cabin, and after being cut to shape was mounted between two strips of mahogany veneer glued on the roof. The masthead light is a small piece of $\frac{3}{8}$ in. dowel hollowed out and painted white inside and black outside with a piece of celluloid for the glass.

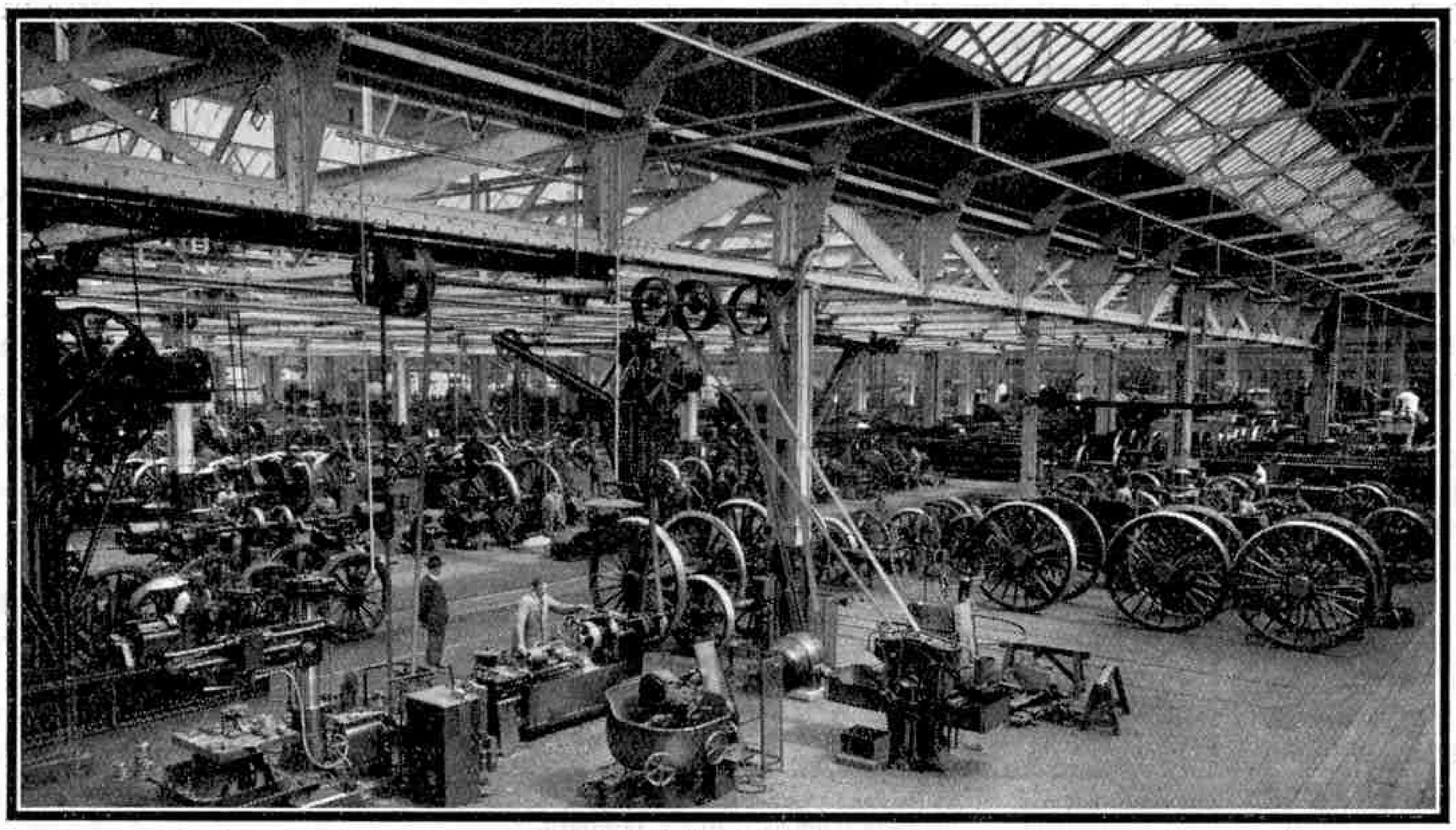
Installing a New Machine at Swindon Works

By R. J. Blackmore

THERE is probably no more illuminating reflection on the wonderful mechanical age in which we live than the railway works machine shops; and in the matter of securing the latest and most ingenious types of machinery the Great Western Railway Company, in particular, have always shown the greatest enterprise. Hardly a week goes by without some new addition, embodying the best principles of modern practice; and an old-fashioned predecessor which, a short time before, seemed as permanent as the factory itself, makes a quiet exit, to be remembered no more. It is interesting to observe how a new machine is laid down.

Although the machines themselves are constantly changing in design, the general principles for installation remain unchanged.

First of all a suitable site is decided upon and cleared up in readiness. Then comes the machine-tool fitter who, by the aid of plumb-bob, square, and other instruments of alignment, ascertains the exact position for the machine.



The wheel shop at Swindon Works where there is a variety of interesting machines. The operations carried out in the preparation and repair of locomotive wheels include dealing with the tyres, the pressing of wheels on to their axles and the turning, quartering and final balancing, in all of which the greatest accuracy is necessary.

Next on the scene is the carpenter, who constructs a flat wooden pattern, or template, of the outline of the underneath part of the machine, being careful to include all holes corresponding with the bolt-holes that already exist in the bottom casting of the machine for the purpose of accommodating such bolts as will eventually secure the machine to its foundation.

The completed template is then placed in position on the floor and, by its means, together with detailed advice from the fitter, the "brickies," next in the operations, are able to excavate as required and to build up a suitable foundation, sometimes of bricks and mortar, sometimes of concrete, or a combination of both, leaving cavities where holding-down bolts are placed loosely ready to be cemented in when the new machine has been moved into position.

When the foundation is ready, the machine is transported from the railway wagon in which it has arrived from the manufacturers, to its prepared site. This part of the proceedings may seem unworthy of comment, but actually it involves much forethought, skill, and labour. There is no broad highway along which the machine may proceed majestically; instead, it has to be pulled, pushed, joggled, coaxed, and bullied past all kinds of obstacles, and steered through labyrinthine lanes of existing plant. However, the labourers, who form part of what is known as the "heavy gang," are always equal to the occasion, and by the skilful use of rollers, ropes, and crowbars, succeed in propelling the machine, if somewhat slowly, to its destination.

The "heavy gang" then engage in manœuvring the machine on to its foundation, where it is next set in perfect alignment by the fitter. The simple method generally employed of "squaring up," is to drive small steel wedges between the base casting and the foundation, so that by placing a spirit-level on any convenient horizontal surface that the machine may possess, it is possible to obtain an "even keel," so to speak, by driving each wedge discriminately until the spirit-level registers a perfect adjustment. It thus follows that a certain degree of space, governed by the thickness of the wedges, exists underneath the machine at this stage, but this is quite necessary.

The "brickies" are next again in demand. They proceed to build a cement wall, about six inches high, all around the base of the machine and about six inches out from the base, thus forming a trough. They then prepare a mixture known as "grout," consisting of two parts of fine grit to one part of cement, and mixed very wet to render it fluent. This grout is carefully poured into the prepared trough, from where it flows to the spaces underneath the machine and into the cavities where the holding-down bolts are loosely suspended.

The grout is then allowed to set, and later, all that is superfluous, together with the cement wall, is chipped away, leaving the machine well and truly joined to its foundation. The nuts of the holding-down bolts are given a final wrench, and the laying-down is complete.

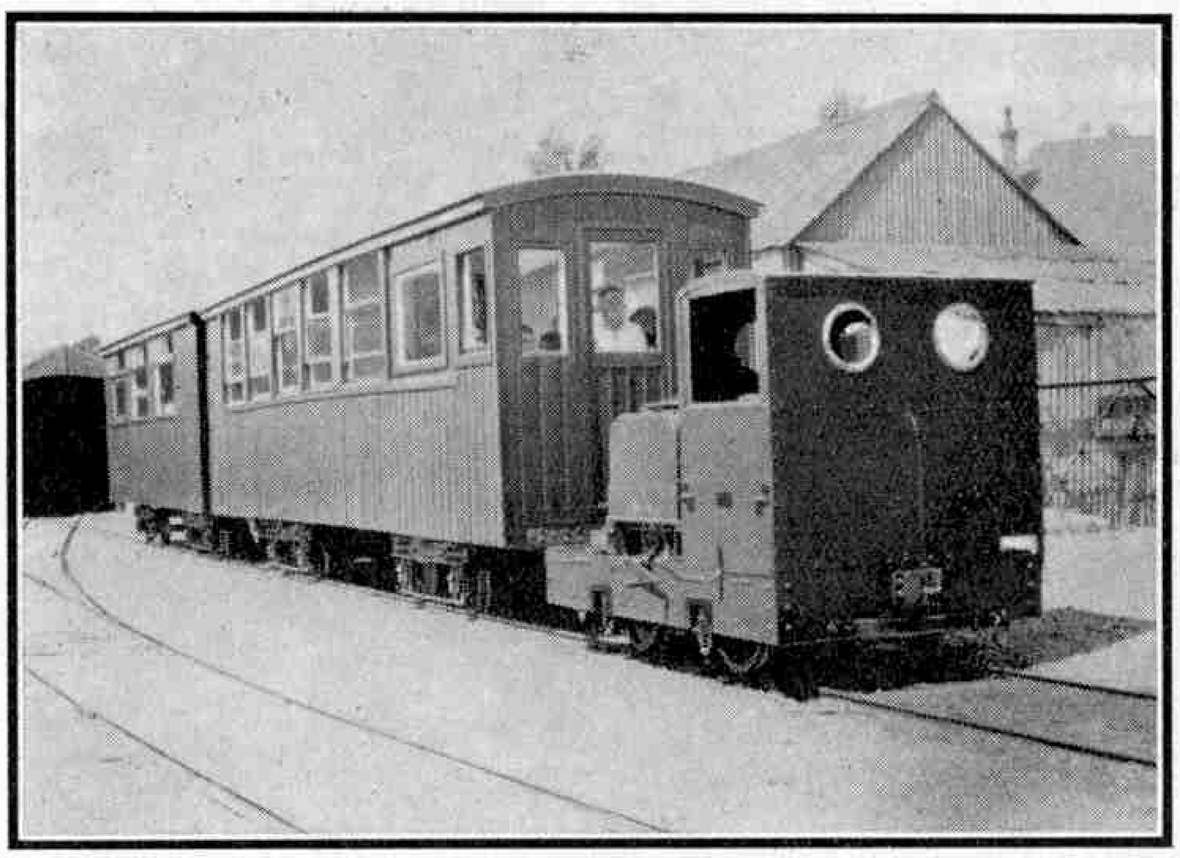
What follows before a trial is possible (Continued on page 186

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Novel Railway in Sussex

One of the smallest railways in England is in Sussex, and runs between Rye and a small seaside bungalow town called Camber. This railway is a source of interest to visitors, who are amused to find that the engine driver also is the ticket collector, the station master and the engineer.

The engine is a petrol motor with a small radiator and a bonnet that is not always used as a cover. The driver takes his position in a small green cab mounted on the chassis, and before starting he goes round to the far side of the "tram," as it is termed, takes a handle from a small cupboard, and cranks the engine. The coaches have wooden seats that are not particularly comfortable, and in fine weather, when the train is crowded, two trucks are added to serve as open air carriages.



The train that runs on the Rye and Camber Railway, with its petrol locomotive at its head. Photograph by J. Burke, Liverpool.

The track is single, and there are loops at each end to allow the engine to run round the train. The driver need not get out of his cab in order to uncouple the coaches, for he can release the coupling by means of a wire controlled from the driving position. The distance between Rye and Camber is roughly two miles and the journey is made in 20 minutes. An interesting feature is that water for the inhabitants of the bungalows at Camber is carried on the train.

When the trucks are full, the engine often has to make two or three efforts before a start is effected. On arrival at Camber, it is interesting to leave the train quickly and look back, for the coaches disgorge more passengers than the little motor seems capable of hauling, and these spread out across the sandhills in a comical manner. After a rest of five minutes the train "chugs" back to Rye.

J. Burke (Liverpool).

My Visit to a Native Kraal in Natal

When I visited a native kraal in Natal, I was given a present of a string of beads and allowed to enter a hut. A girl then went out, and returned a few minutes later with a basket of mealies, which she crushed in a huge stone that had been hollowed out like a basin, grinding them into a coarse powder with the aid of a smaller round stone. She then explained that the ground meal was to make a kind of porridge.

A native kraal usually is built on the side of a hill and near a stream, and includes from nine to 12 huts. There are always plenty of fowls about, and these seem to be allowed to go wherever they please. Around the kraal I visited I saw an abundance of maize, Kaffir corn and other types of grain, in addition to lucerne. These products are used by the natives themselves, and surplus quantities are taken to the "umulegu," or white man, at the trading store, where they are sold for cash, or exchanged for blankets, plates, knives and mirrors.

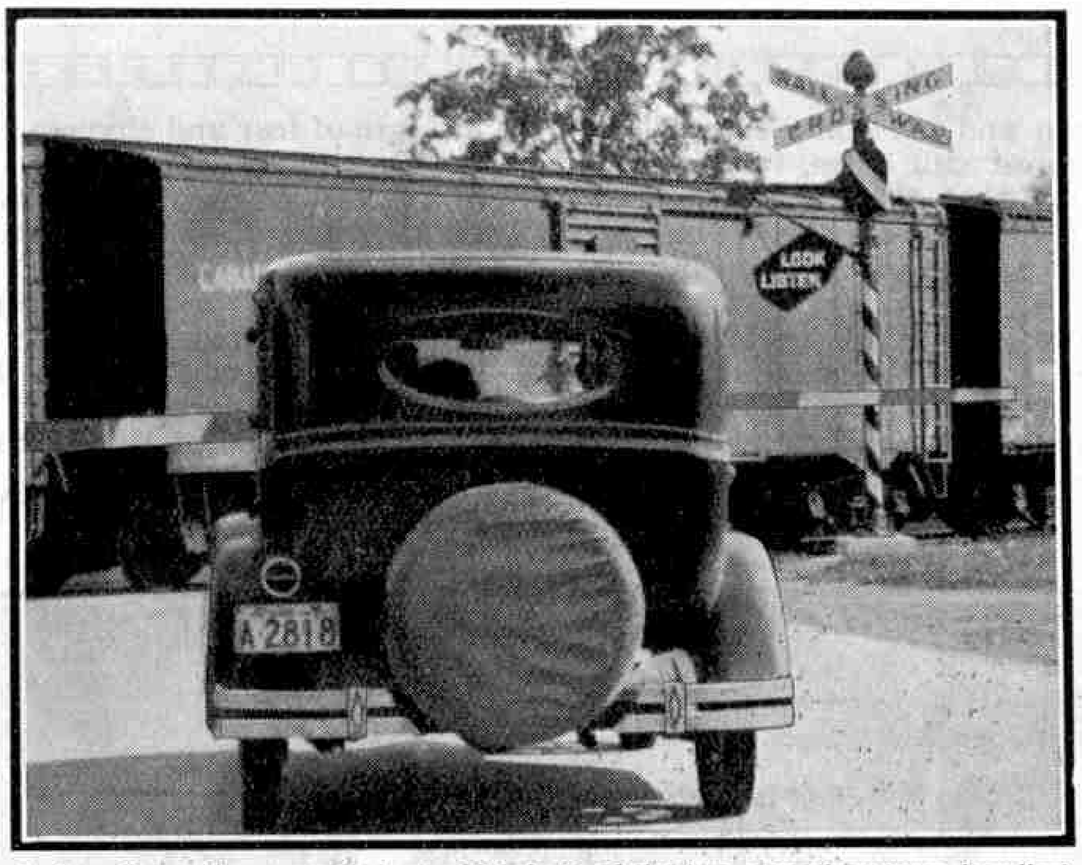
A scene in Natal. A wagon hauled along a road across the veldt by a team of oxen. Photograph by P. M. Clapham, Pietermaritzburg.

The women seem to do most of the hard work, for they hoe the ground, and plant and reap the mealies, in addition to cooking and washing. The younger boys take the cattle, sheep and goats into the fields, and the girls help with work in the kraal.

P. M. Clapham (Pietermaritzburg).

Level Crossing Control in Canada

On a recent trip to Canada I was interested in the number of controlled level crossings on railways in the suburban areas of large towns. Very few of these crossings are controlled by manually or mechanically operated gates. In one system that is largely employed control usually is exercised by means of a barrier that is raised and lowered by a signalman. In another and less common system a vertical column is erected at the side of the road. At right angles to the column, and near the top, is an arm from which hang two plates painted black, bearing in white letters the words "LOOK, LISTEN." Between these plates is a pendulum carrying a red lamp that is not visible to road users when the way is clear for road traffic. In districts where there is no electrical supply a bell on top of the column is mechanically operated through levers and rods when a passing train makes contact with a striker on the track. Where current is available, the warning is operated by the completion of an electric circuit by the train when it is about 200 yds. from the crossing.



A Canadian railway crossing at which both of the two control systems described on this page are in use. Photograph by R. M. Buckle, Luton.

When a train approaching the crossing completes the circuit, or actuates the striker, the pendulum swings backward and forward and then shows the red light to the drivers of cars on the road. At the same time, the bell is rung, and this continues until the train has cleared the crossing, and the way again is open for road traffic.

The engine driver is warned of the crossing by means of a white post with the letter "W" painted on it in black. When he sees this post he gives a signal on his whistle, consisting of two long blasts followed by a short blast and another long one. This is done at every crossing, controlled or otherwise.

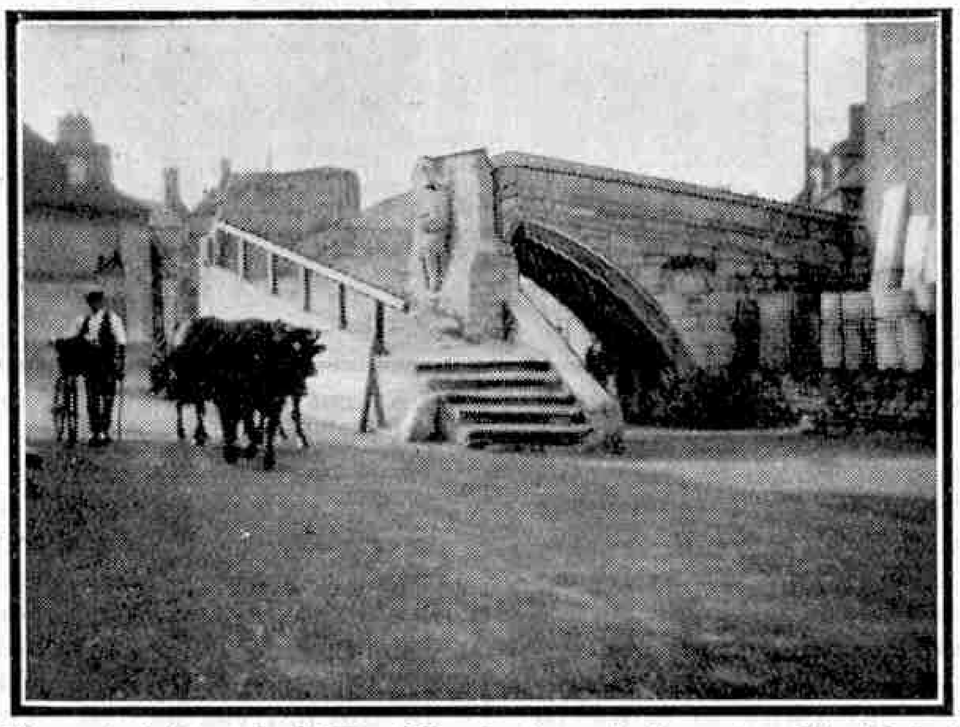
In the country districts, where the roads are mostly of the loose dirt variety, the crossing warning consists of a post placed 300 ft. from the track with arms at the top in the Maltese cross fashion, bearing the words "RAILWAY CROSSING." I noticed that on approaching a railroad crossing of this kind, the drivers of coaches stop and open the doors of their vehicles before proceeding in low gear across the track, and do not close the doors until they have cleared the crossing.

Signalling on the railways over which I travelled during my trip was carried out wholly by electricity, and the visible signals for the engine drivers were given by the two-colour system, without semaphores. I noticed semaphores at a few stations, but they appeared to be unused.

R. M. Buckle (Luton).

The Triangular Bridge of Crowland

It was my good fortune to visit the village of Crowland, or Croyland, to give it its former name, while on a cycling tour in the eastern counties. The most interesting feature of the village is the old bridge, which stands in the centre of the market place and is said to date back to the 6th century. The structure is remarkable, for it consists of three arches meeting at the centre. One explanation of its peculiar form is that it was built at the junction of three streams that no longer exist. It was built high, in order to prevent the streams from carrying it away in times of flood, and its ways therefore are too steep for carriages. Thus it is only a footbridge, and steps paved with small stones, that probably were obtained from the streams themselves, have been provided. At the foot of one of the flights of steps is the stone figure of a Saxon king, which is supposed to represent Ethelbert. The figure is weatherbeaten, but still retains a certain grand aloofness, and it awes one to think that it was carved more than 1,000 years ago.


The ancient triangular bridge of Crowland, now in the centre of the Market Place. Photograph by M. J. Higgins, Streatham, S.W.6.

Authorities differ on many points in connection with the history of the bridge. Some say that only one stream flowed under it, and that it was built with three arches to signify the Trinity. Others give the 9th century as the time when it was built. The present bridge probably is 14th century work, but is certainly a reconstruction of the original structure, for a chart of 943 mentions the triangular bridge at this spot. There is a current legend that the builders walled up their wives in the stonework in order to frighten the Devil!

The ruins of a monastery of the 12th century are also to be seen at Crowland. The original buildings were erected on the site of an earlier monastery of the 9th century. According to the legend, St. Guthlac, the patron saint of Crowland, left a monastery at Repton, and after many wanderings committed himself to the care of a coracle, letting it drift wheresoever it would. It brought him to Crowland, and there he built a hut, on the site of which the Abbey was founded. On the grass around the ancient gravestones there is a little plate that is a reminder of the dissolution of the monasteries by Henry VIII, for it bears the words: "The Monks of this Abbey of Crowland were pensioned off A.D. 1536."

There are only five steps in the "half-arch" shown in the accompanying photograph, but one of the other sections has 13 steps. Each part has three stone ribs, the nine meeting at the centre of the structure.

M. J. Higgins (Streatham, S.W.6).

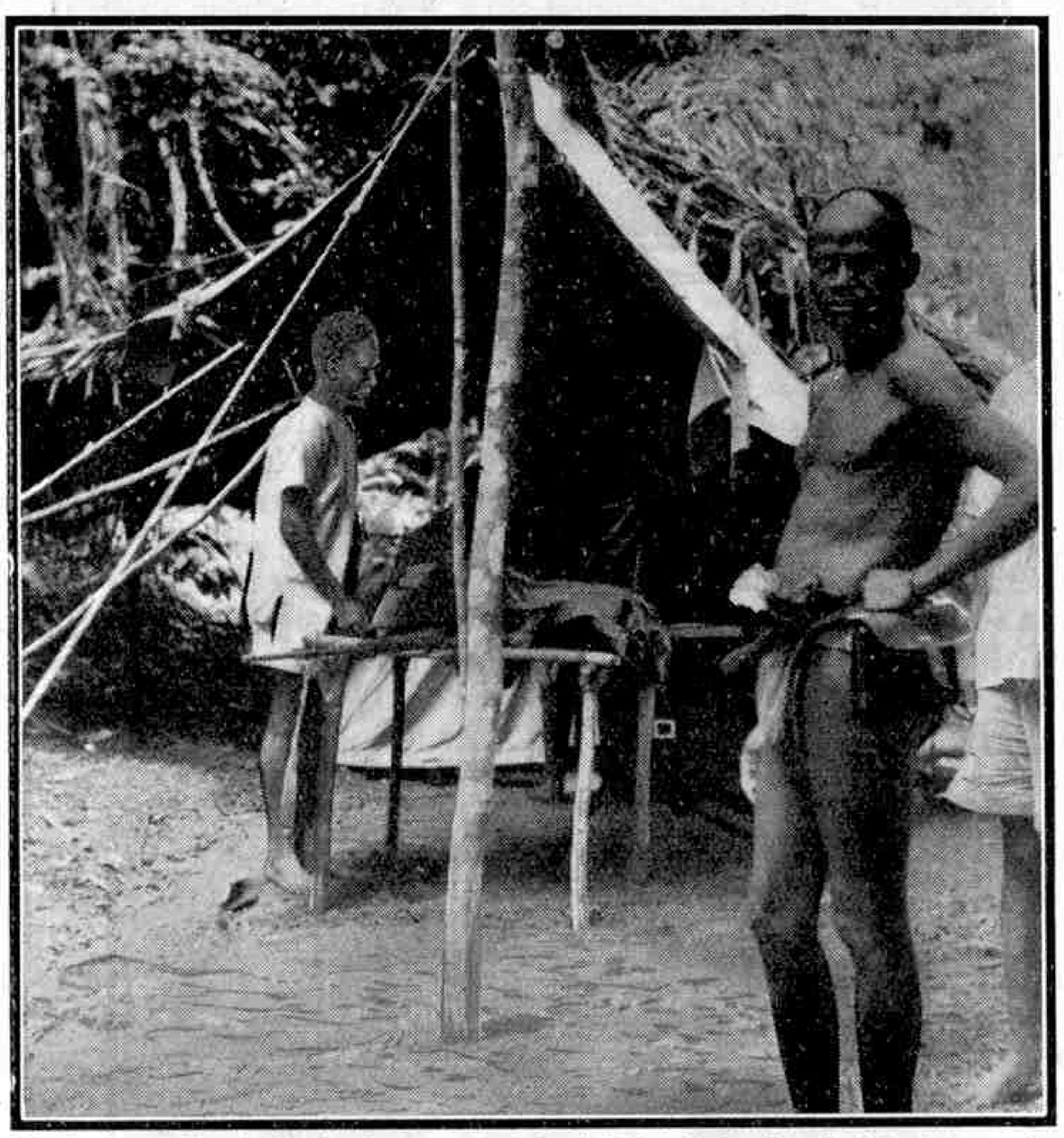
Famous Explorer Writes for the "M.M."

II.—Pygmies' Fear of Mysterious Forest Creatures

WHAT strange creatures, unknown and even unsuspected by human science, the equatorial forest still hides, it would be impossible to say; but I know to-day that there are several. I can easily foresee that the forest will reveal them slowly, one by one, with all the stinginess of a usurer. The forest is so big, so dense, so jealous of her secrets.

The day before I entered the forest I went to see Mr. Absil, District Commissioner at Irumu. He is an active and intelligent man who has spent already 20 years in Congo, and he confirmed to me that that part of the forest west of the road from Boni to Irumu into which we were going was still for the greater part unknown. "The natives," he said, "do not want to go in there. Whether it is merely an excuse to avoid work, or a true fear, I don't know. They speak vaguely of extraordinarily terrifying animals, but they either do not want to or cannot give an accurate account of them. Let me know anything you will be able to discover, for it will be extremely interesting and useful."

Another official a few days before had put forth to me the hypothesis that hidden in the forest is the secret habitation of the actual chiefs of the Kihokohoko, the cruel sect of the Leopard-Men, against which the Belgian authorities in this part of Congo have initiated a courageous fight, without having been able as yet to discover the real ringleaders. Even if this conjecture is true, who could hope to discover the secret hiding place in that unending ocean of vegetation? The District Commissioner, moreover, and the few Administrateurs and Agents Territoriaux under him, have other things to do than to explore the forest, embarked as they are upon a work so gigantic that one simply cannot understand how it can be carried on by so few whites in a district six times larger than Belgium itself.



Okapi Camp No. 1. In the foreground, Sultani Kalumé who described to Commander Gatti the mysterious Mulahu.

New roads are being built to even the smallest posts, and now a new one will join Beni to Fort Portal, bringing the marvels of the Ruwenzori and its ascension within reach of every tourist. Entire populations scattered along the shores of Lake Edward and of the Semliki River, where in a few years they would have been destroyed by sleeping sickness, have been laboriously removed and transplanted to points along the Luboro-Beni-Irumu road. Huge slices of the forest have been cut away in order to establish big villages, orderly and clean, where the natives, painstakingly reunited to their old tribes and sub-tribes, can live hygienically. They can be controlled and cared for by the impressive sanitary system of Congo, and instructed by the territorial authorities in the preparation of gardens and plantations that will protect them from now on from the other great enemy that has hitherto weakened and decimated the race—famine.

Travelling by motor from Lubero to Irumu one receives the most contradictory impression of this state of things. Looking at those immense, spotless villages surrounded by flourishing gardens, one thinks the population must have been established there for a long time and must be already in an advanced state of civilization. But if one stops and calls to the natives he meets passing along the road, he finds that in nearly every case they will take to their heels and dive into the vegetation, actuated by a mixture of fear and shyness. The road itself, so well kept, gives to the dark forest that borders it for the greater part the appearance of a luxuriant park. But it is enough to step two paces from that road to find oneself completely lost in another world, without a trace of human passage, and penetrated only by the openings left in the thickly woven underbrush by elephants and buffaloes and cynocephalus and wild hogs. Strangest of all, the natives have no knowledge whatever of the forest on whose edges they live, as their short occupation of this country has not banished from them the terror of that unknown jungle inspired in their plain-dwelling fathers.

There are a few pygmies living with these tribes in a sort of servitude that is actually quite a pleasant condition of co-operation wherein the pygmies supply the meat and skins in exchange for vegetables and points of spears. These pygmies have entered the forest here and there, but game is so abundant that they do not need to make long hunting expeditions, and these little wisps of men, so intrepid as to attack with their rude spears the buffalo and the elephant, are terrified at the very thought of the terrible monsters reputed to live in the heart of the forest. So, when at kilometre 104 we left the road heading westward, less than two days' march brought us to the place that the pygmies declared was the farthest point they had ever previously reached.

What should we find farther on? The porters and the pygmies, at every question regarding the strange animals they themselves had formerly described with so much conviction, entrenched themselves behind a complete and sudden ignorance. And so, in the beginning, I came to the conclusion that all these tales of weird and frightful animals were nothing but the creations of a childish imagination.

Then, gradually, my opinion began to change. Some small fact recalling to my mind other facts previously observed; some significant gesture I noticed on the part of a native; some remark I overheard, led me to believe that the stories I had heard, fantastic in appearance, were in all probability only exaggerated accounts of animals actually existing. Slowly but steadily the diffidence of the natives melted. After a few months of common life in the forest they began to trust me, to give me their confidence, to talk with me more and more freely of these tabu subjects, and to show and explain to me things that otherwise I should never have been able to observe or to understand. In the end I acquired the certainty that at least three of those animals actually exist. Strange animals, living only in the most obscure, still unexplored parts of the forest, and so rare and wild it is no wonder they have hitherto eluded human knowledge.

So it is for the *ndegi*. This word means simply "bird," in general, and I have not been able to learn the particular name that the natives give to this bird—if there is a name, for they say, if one calls by name this creature "one calls death on himself." They affirm that it is taller than a man, possessed of great strength, covered with hair instead of feathers, and with a head similar to a monkey's. This description may sound grotesque, and perhaps

it is in part. But one day I heard a beating of wings so loud and so heavy that it startled me. The pygmies said in an offhand way that it was only a bird, but I noticed that each of them raised his right arm in the air and snapped his fingers, as they do to exercise the evil spirit of the lightning in the great forest storms.

Again, one night I heard a singular sound. One native, in answer to my question, glibly replied: "It is a monkey"; another: "It is a night bird." But I was ready to swear that that strange sound was made by neither monkey nor night bird.

And at last, one morning as I was walking through the forest, the sound of leaves pushed aside by some heavy body brought me to a stop, my rifle at my shoulder. An okapi, or a buffalo, I thought, but I was puzzled at the conduct of the pygmies, who had all thrown themselves face downward on the ground. I had the sensation that the big body hidden from me by the foliage, for visibility in the forest does not extend beyond five or ten yards, was moving away from me and upward, and I ran forward to try to get at least a glimpse of it. Then I heard once more that strange sound, coming from above the green dome of interlaced branches covering me; and looking up I saw through an interstice in the leaves something black and immense passing over me.

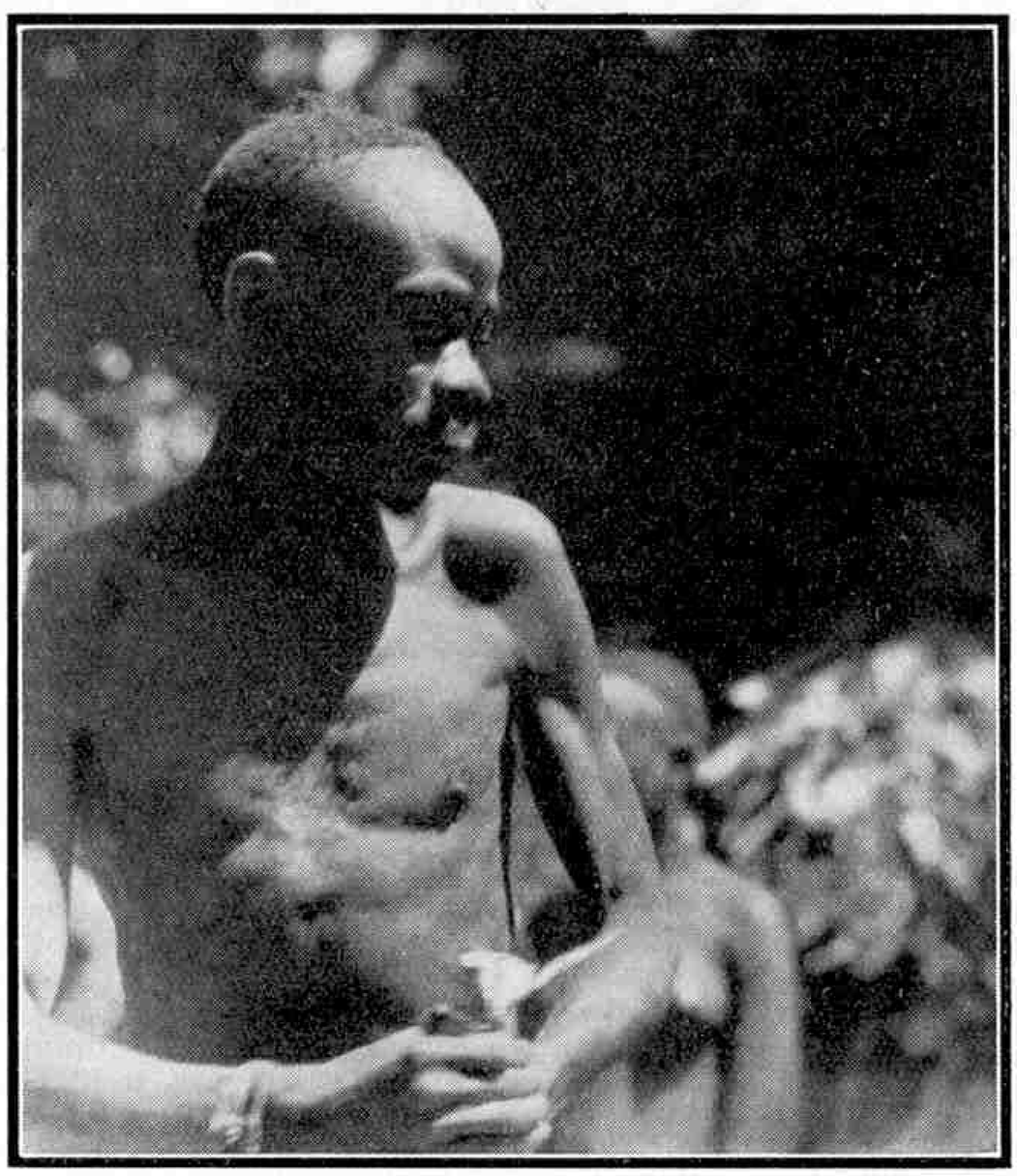
Native women bringing huge loads of firewood to the camp kitchen.

Those few seconds of hesitation had lost for me a clear sight of the *ndegi*. For *ndegi* it was, although it was not until several weeks later, so great was their fear of this ill-omened bird, that the pygmies confirmed the fact to me.

I believe to-day, even at the risk of appearing ridiculous, that there exists a great ape, larger than the gorilla, red of hair and differing from the gorilla in the fact that it walks always on its hind legs and stands erect like a man. In the Tchibinda Forest near the Lake Kivu the pygmies spoke of it in awe as of a being more man than gorilla, possessing phenomenal strength and intelligence. A white man who has lived there for many years, and whom I esteem very much, assured me that about 20 years ago one of these monsters was killed by the poisoned arrows of some pygmies whom he had attacked. The territorial administrateur of that time himself saw it, but when he returned to the spot a few hours later to take the skin, he found that it had been burned by a missionary who feared that it might be considered a proof of the Darwin theory, which was not in accord with his religious principles.

These stories may or may not be exact in every detail. When I first heard them I thought that if they were correct they must refer to an abnormal individual. But one day the witch doctor of the pygmies there in the Tchibinda Forest showed me in great secrecy a piece of skin. It was the same skin as the gorilla's, covered with the same long coarse hair, but the colour of the hair was the vivid shade of red of a red-haired man. But although I made patient researches, I never was able to find any animal having such a coat.

And now, here in the Ituri Forest, at more than 600 miles distance, the local pygmies, who do not even know of the existence of the gorilla, have spoken to me of a gigantic man covered with long red hair who lives far away in a part of the forest where they would not go for anything in the world. And they have described the animal to me in minute detail, and with an air of such conviction that it is enough to know even a little of the pygmies to understand that, while their description may contain much exaggeration, it refers to an animal actually existing.



Makulu-kulu, the sultani of the Mambuti pygmies.

Finally, there is the *mulahu*. The hours of march this creature has cost me, both before and after I became convinced of its existence, only I can know. Ten times it has happened to me to be walking on the tracks of an okapi, or in search of a bongo, or to be following a river just discovered, when suddenly, without any plausible reason whatever, my natives, even the best ones, refused to advance an inch further. Excuses of every kind, palpably excuses, greeted my insistence until, humiliated and annoyed, I was obliged to turn back, well knowing that to continue by myself through the forest would have been sheer madness. Groups of men who, after indescribable efforts, I had succeeded in sending off to prepare a camp or holes in a certain part of the forest, invariably returned the following morning assuring me that they were all sick. And, furthermore, having the appearance of it.

It took four months before, word by word, I succeeded in dragging out of Sultani Kalumé the real reasons for these deceptions. All the fault of the *mulahu!*

The physical description of this animal is not particularly terrifying. He is about four feet in height at the shoulder, and seven or eight feet long from the head to the end of the tail. He is covered with long hair that falls over his face, and has a coat that is black on the top and white underneath. But the natives say that he lives in the hollow trunks of trees that his mere presence has been enough to kill and dry; and they swear that if a *mulahu* sees a human being he immediately tears out a handful of his hair and blows it in the face of the man, who dies on the spot by a quick and painful death.

Usually in such native talk it is impossible to say exactly where truth ends and invention begins. But Sultani Kalumé, a very serious and intelligent chief, has assured me that he has seen with his own eyes one of the victims, horribly disfigured, inflated, and with the skin discoloured to a dark red. He has also showed me a hair of *mulahu*, religiously kept in his medicine horn; and after much reluctance, two trunks in which *mulahus* formerly lived. Both trunks are those of enormous trees that had been struck by lightning. The cavities within them show evident signs of the inhabitation of an animal corresponding to the measurements Kalumé had given me, and they are in such condition that they do not suggest that they have been the shelter of any known animal particularly the black and white colubus of which I had thought at first in spite of the protests of Kalumé, who is an assiduous eater of the colubus and other monkeys.

By P. A. Tent

Quaint Ideas of Inventors

Patent offices are storehouses of eccentric ideas as well as of great inventions. For instance, among the strange schemes recorded in the specifications in the British Patent Office is one for getting gold from chopped wheat straw by soaking it in water for 24 hours, and removing the scum that forms on the surface of the liquid. This scum was alleged by the patentee to contain the precious metal, but nobody has ever made a fortune by this simple process.

An equally remarkable invention that was literally a wild goose idea, for its author's name was Wildgoose, was a wonder vehicle that would plough the earth without the aid of horses or oxen, and was also an ocean-going vessel, swifter in calms and safer in storms than a boat in full sail. The description suggests an anticipation of the modern amphibious tank, but the scheme was impossible in 1659, when the patent was taken out. A comparatively recent invention that was even more absurd was a combined gun and helmet, details of which were lodged as recently as 1916. The trigger of the gun was operated by a pneumatic bulb held in the wearer's mouth, and as his head would be called upon to withstand the shock of the recoil, it is easy to see why a well-padded lining for the helmet was specified. I do not think the adoption of the helmet was ever considered seriously, but how valuable it would have been can be realised from the fact that the top could be used also as a frying pan!

The absurdities of the Patent Office were not always on the part of the patentees, however. When the inventor of an electric telegraph suggested in 1823 that the Government was unjustifiably slow in trying his invention, he was officially informed that electric telegraphs were considered to be too fantastic to be of any service, and that none other than the semaphores then in use would ever be adopted.

The first patent ever issued was granted in 1617 to a London publisher, who was accorded the privilege of engraving pictures in copper, brass and other metals, and printing impressions from his plates. A patent of 1718 that deserves special mention for a different reason is partly in rhyme, but its chief claim to notice is its nature, for the specification describes a portable cannon to fire round bullets at Christians and square bullets at Turks. It would be interesting to know why square bullets were thought necessary for Turks.

Humane Rabbit Trap Wanted

The many directions in which the ingenuity of inventors can be exercised is well illustrated by the announcement that the Royal Society for the Prevention of Cruelty to Animals are willing to award £300 to the inventor of a rabbit trap that kills these creatures instantly and without pain. The steel-toothed trap now so largely employed is not regarded as satisfactory, and there is a demand for one that is simple and inexpensive, and easy to manipulate. No contrivance in which poison, gas or explosive is used will be considered.

The R.S.P.C.A. have previously organised competitions in the hope that a rabbit trap answering to their requirements would result, but so far no satisfactory device has been produced. It is suggested that those interested should study carefully the steel trap at present in use, which it describes as a standard for everything but humanity; and it is pointed out that a sound general knowledge of the habits of the creature to be caught, as well as of the type of mechanism to be used, is necessary to ensure success.

A parachutist equipped with a lighting set. The lamps on his belt and wrists are supplied with current by the air-driven generator mounted on the back of his head. Photograph by courtesy of Ediswan Ltd.

Lighting Sets for Parachute Jumpers

On this page is shown an illustration of a parachute jumper who is equipped with a lighting set. The reason for this novel addition to his equipment is easy to understand, for now that night flying is comparatively common, it is obvious that parachute jumps may become necessary in darkness. A parachutist who is equipped with a light can illuminate the ground below him, and this may help him to avoid unpleasant consequences. In addition it will warn people on the ground, and will enable them to find the jumper and to give him assistance if he has sustained injury.

Current for the lamps in this equipment is provided by a wind-driven generator. In a test at Hanworth Aerodrome, the parachutist wearing the outfit jumped from an aeroplane that was travelling at high speed, and the three points of light given by the lamps on his belt and his wrists whirled across the sky at tremendous speed. He raised his wrist lamps and illuminated his parachute on several occasions during his descent as signals to those on the ground who were watching his progress, and landed as easily and as safely as if the test had been made during daylight.

A Substitute for the Blackboard

Many common devices remain in operation year after year, in spite of their crudities, because better means of effecting their purposes are too costly or too elaborate. An interesting example of this is the use of the blackboard and chalk in school work and lectures. This practice has many disadvantages. Chalk is not a pleasant substance to handle, and gives rise to a considerable amount of dust, which is particularly objectionable when a blackboard is being cleaned. In addition the art of blackboard writing is not easily acquired by some teachers and lecturers, while others continue to talk while writing or drawing, so that their explanations often are not heard by their audiences. A further objection is that rubbing out words or diagrams chalked on a blackboard early in a lesson or demonstration makes it difficult to refer back to them.

An interesting effort to do away with the blackboard, with all its drawbacks, has been made by the famous optical instrument firm of Carl Zeiss Ltd., who have produced an ingenious form of lantern that projects words, figures and drawings on to a large vertical screen as they are produced on a small sheet of cellophane resting on a piece of glass. Mirrors reflect the light of a powerful lamp through the cellophane, and the audience see on the screen the shadow of the end of the pen, which seems to write on the

screen itself, making letters and figures that can easily be seen.

The cellophane sheet is really a film passing over its glass support from one roller to another, and can be turned back again without difficulty when reference to something previously shown is necessary. A special ink that can easily be cleaned with a damp duster is used, and a piece of ground glass can be substituted for the cellophane film to enable coloured pencils to be employed. The instrument also projects lantern slides laid under the cellophane, and a lecturer can add to diagrams shown in this manner by drawing or writing on this covering material.

The projector is much neater and cleaner to use than a blackboard, and no doubt effective use will be made of it by lecturers; but I am afraid it will be a long time before it displaces its cruder and cheaper rival from schools.

Recording Telephone Talks

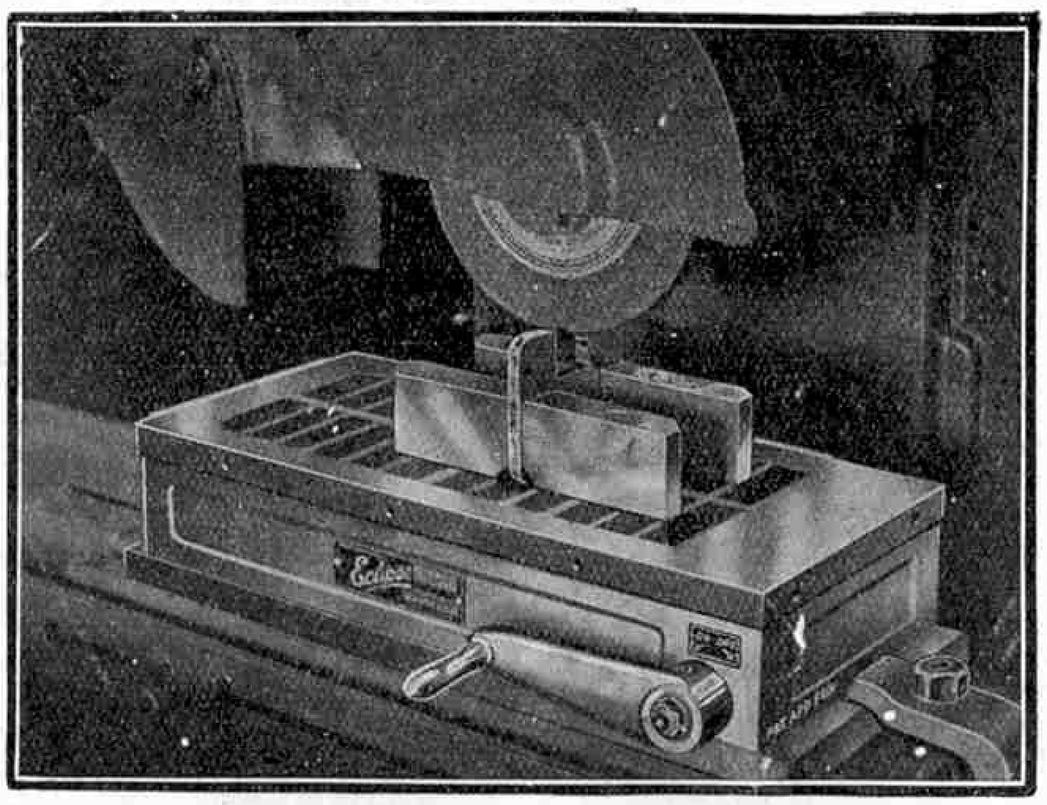
One field in which the inventor is continually at work is in the improvement of business communications, and among recent additions to the resources of the business man is the Telecord, an instrument for recording telephone conversations. This is shown in use in the upper illustration on this page. Where it is installed, the varying electrical currents produced by speaking into a telephone can be transformed into serrations on the track of a Dictaphone record, and this can be filed away to enable the conversation to be reproduced if required, or transcribed immediately. The use of the invention with the standard telephone has been approved by the Postmaster-General.

Another advantage of the Telecord is that telephone messages for people who are absent can be recorded fully and accurately by anyone receiving the calls. This avoids the necessity for relying upon the memory of an individual who perhaps is not conversant with the subject of the call, and therefore may make serious errors.

The Telecord in use for making a permanent Dictaphone record of a telephone conversation. If desired, only the incoming message is recorded. Photograph by courtesy of the Dictaphone Company Ltd.

An Ingenious Use for Permanent Magnets

The lower illustration on this page shows a portable magnetic chuck in use to hold down material on which work is being carried out. Magnetic chucks are not new, but those previously employed were electro-magnetic, the magnets holding the material as long as current flows through their windings, and releasing it when the current is switched off. Electric current is not required for the new chuck, which instead introduces a novel and ingenious scheme for using permanent magnets. Thus there is no necessity for a generator or rectifier to provide the required current if a suitable supply is not available, and as no wiring is needed the chuck can readily be transferred from one machine to another.



A magnetic chuck holding a gauge in position for internal grinding. Photography by courtesy of James Neill and Co. (Sheffield) Ltd.

In the illustration the chuck is being used to hold steel blocks clamping between them a gauge that is undergoing internal grinding. The steel blocks in turn are firmly held in position by the magnets, of which there are eight, in two rows of four each. The magnets themselves are invisible, for they are in the interior of the device, and the rectangular markings seen in the photograph are pole pieces, consisting of blocks of steel embedded in the top of the chuck, which is made of a non-magnetic alloy. There are three of these blocks to each of the magnets, because the magnets have three poles, the middle one in each case being of opposite polarity to the outer ones. When the magnets are in use, the lines of magnetic force from the outer poles to the inner one pass through the steel pole pieces, which are therefore held firmly in position.

The most ingenious part of this device is the means adopted for releasing the work, for in effect this amounts to "turning off" the magnetism. When the handle in front of the chuck is turned over, the magnets are moved sideways so that the pole pieces are in the positions of keepers, bridging the gaps between the opposite poles instead of being directly above them. In this position they concentrate within themselves the lines of force that previously passed through the work, and therefore act as keepers. Exhaustive practical tests have shown the chuck to be efficient, and in ordinary use the magnets retain their attractive powers permanently.

Tracking Wandering Oil Borings

Probably many of my readers think of an oil well as a narrow vertical tube leading to the underground reservoirs of this fluid, and the crowding together of derricks on oil fields suggests that this is the case. In reality the bore of an oil well may be exceedingly crooked, and there is a record of one drilled on the coast of California to a measured depth of 4,622 ft. that had wandered nearly half a mile to one side of the vertical line below the drilling rig. The bottom of this well actually was 1,390 ft. out to sea.

It might be thought impossible to track the wanderings of an oil well that has gone astray in this manner, but a very ingenious instrument invented by an American engineer enables accurate surveys to be made. The instrument is a hollow casing that is lowered into the boring. At the lower end of the interior of the casing is a compass over which hangs a plumb bob. This is illuminated by means of flashlamps, and at short intervals is photographed by means of a tiny camera set vertically above the centre of the compass card. A small watch makes the exposures automatically by closing an electric circuit, and thus a record of the positions of the plumb bob at various depths is obtained. These indicate the inclinations of the boring at the point where the exposure is made, and also show the direction of the hole.

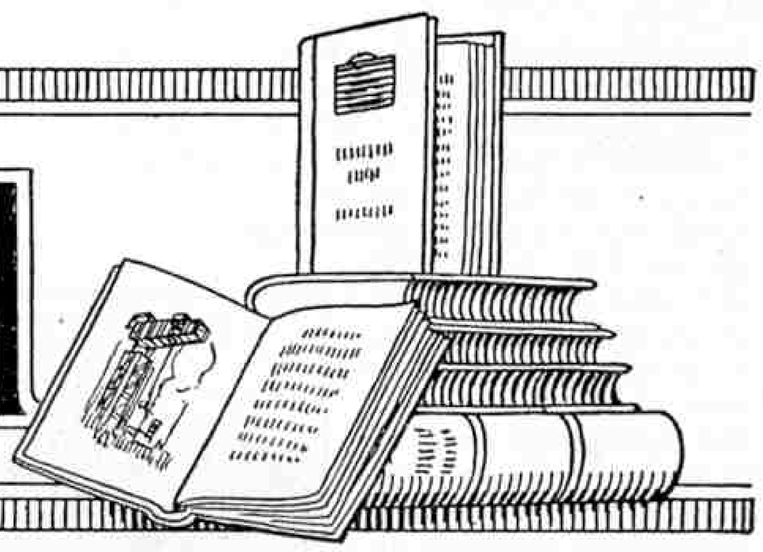
The photographs are taken on small sensitised discs, and when the instrument has been hauled to the surface these can be developed and fixed, ready for examination, in four minutes. The device therefore is rapid enough in action to be used for checking the direction of a well during actual boring.

Inventions Wanted

It has often been complained that inventors waste their time in creating things that nobody wants. To a certain extent this is true, and the lists of inventions wanted that are published from time to time by the Institute of Patentees will do good work in showing inventors the direction in which their energies should be expended.

An interesting list of suggested inventions that I saw recently included rubber doors that would shut quietly, a contrivance to guide latch keys into key holes and buckets provided with castors. The third of these suggested inventions seems absurd, but there is no doubt that success awaits a cheap and efficient method of avoiding the horrible effect of the scraping of metal buckets along stone or concrete floors, especially if the appalling clatter usually made when such a bucket is put down also can be subdued. Another suggestion that seems to offer interesting possibilities is an electric vacuum chimney sweeper, and it seems surprising that nobody has devised cleaner and less disturbing methods than those now in use.

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books vary, but any balance remaining will be refunded.

"The Kingdom of the Camera"

By T. Thorne Baker. (Bell. 7/6 net)

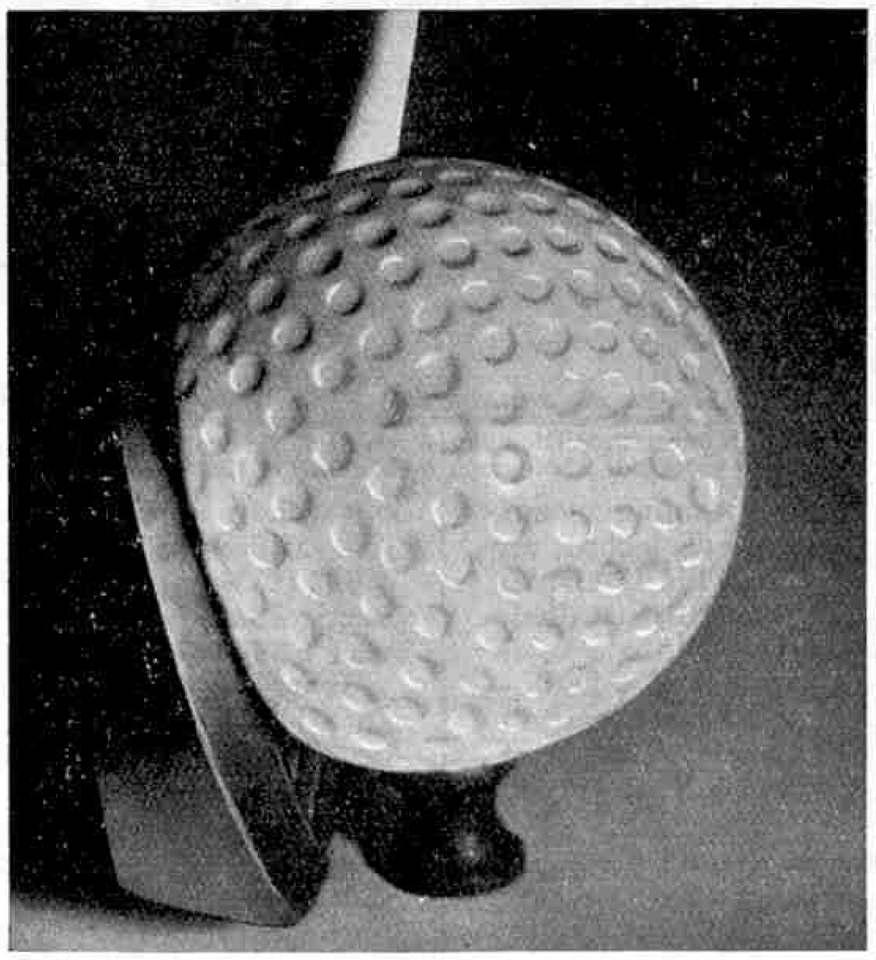
In a foreword to this volume Professor W. H. Bragg remarks that the present is a fitting time for a review of the development of photography because the practice of this art is just a century old. Mr. Thorne Baker's wide knowledge of photography makes him thoroughly competent to explain the manner in which it is now applied in science, industry and art, and he reveals a range of uses that will be astonishing even to many who think they are familiar with the power of the camera.

The author tells us that photography, or the art of drawing by light, began more than 360 years ago, when an Italian named Daniello Barbaro built a huge camera in which he could sit and draw on a piece of white paper the image cast upon it by the rays of light from a spectacle lens. Thanks to the pioneer work of Niepce, Daguerre, Fox-Talbot and others, the drawing is now made automatically on the sensitised plates and films we insert in our cameras. These respond to short exposures, in some cases of as little as a millionth of a second, and the extent to which they are used is illustrated by the fact that in one English factory alone three tons of silver are dissolved in nitric acid every week in order to provide the sensitive material required for the films and papers used by photographers.

The chief purpose of the book is to show how photography is applied in modern life. To tell the story completely would require many volumes, but Mr. Thorne Baker has succeeded in showing the extent of the kingdom of the camera in a series of chapters devoted to special uses. He begins with the use of the camera in the air, and describes the wonderful modern instruments that have enabled the ground to be surveyed from the air more quickly than by any other method, and at much less cost, especially when the area to be covered cannot easily be penetrated on land.

The following chapters deal with photography in the entertainment world, in medicine and industry, in the service of engineering, as an aid to the detective, and a means of illustrating our daily newspapers. In every case a thoroughly up-to-date review of recent applications is given. For instance, in connection with medicine and industry the use of the photographic plate in conjunction with X-rays is fully dealt with. Without the camera, X-ray work in general would be much more arduous than it is, for photography gives permanent records of the things that the penetrating radiation sees, and these can be studied at leisure.

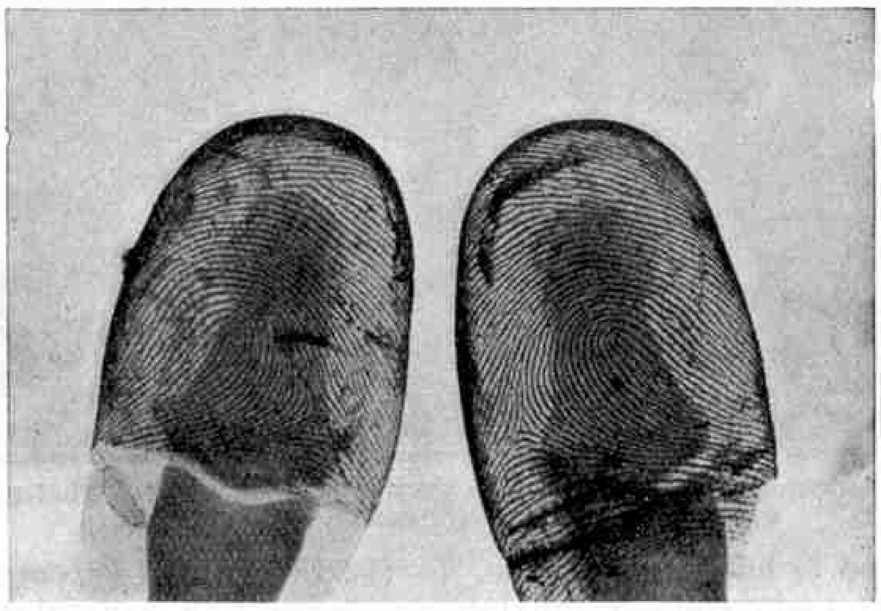
Photographs taken with the aid of the microscope, or of the X-ray tube, are invaluable to engineers, who can look below the surfaces of their creations in order to detect hidden flaws, and even to find if any changes have taken place in the minute crystal structure upon which the strength of many structural materials depends. Slow motion cinematography also is now largely applied in engineering work in order to enable the movements of high-speed machines to be closely studied, and films taken with successive exposures of only one millionth of a second, and projected at ordinary speeds, make chips from worked steel, revolving at 3,000 ft. a minute in the lathe, look like snow flakes floating gracefully downward. Occasionally the camera produces surprises. One of these is shown in the upper illustration on this page, which reveals the fact that a golf ball is flattened on one side by the impact of the club head.



A photograph, taken with an exposure of one five-thousandth of a second, showing that one side of a golf ball is flattened when struck by a club. (See below.)

A chapter of special interest shows how the camera is used in the detection of crime. The greatest wonder of criminal photography in this respect is that its results are visible to the untrained eye of members of a jury. For instance, forgery often can be revealed at a glance by the photography in ultra-violet light of a suspected document; a photo-micrograph of the marks on a bullet will show whether it has been fired from a particular gun; and the combination of microscope and camera with the spectroscope has been known to convert a tiny speck of blood into convincing evidence of murder. Finger-prints are recorded by photography, and enlargements can be used to enable accurate comparisons to be made and demonstrated to juries. New uses of this kind are continually being found for photography, and staff photographers are now common in police and detective forces.

Special sections are devoted to the transmission of photographs by wire and wireless, and to television—subjects in which the author has himself been a pioneer—and to photography in colour. The last chapter deals with the camera and the press. It is not many years since photographs began to appear in our newspapers, but photographic methods are now so speedy that a late afternoon snapshot can be published in an evening paper within an hour or so of the exposure. Newspapers without photographic records of important events are now unthinkable and the author gives an interesting account of the means adopted to reproduce press photographs and shows us something of the activities of the photographers themselves. Enterprise and courage are required from those who provide us with news in pictures. One example of this given in the book is the descent of a press photographer into the main crater of Vesuvius. In the words of the author "he was let down by a rope on to the bed of hot stones and cinders, and in the tremendous heat of 180 degrees Fahrenheit—where his boots were almost burnt off his feet—he secured a number of astonishing pictures of the highest scientific value."



Finger prints photographed by means of X-rays. The bones of the fingers can be seen. (From "The Kingdom of the Camera," reviewed on this page.)

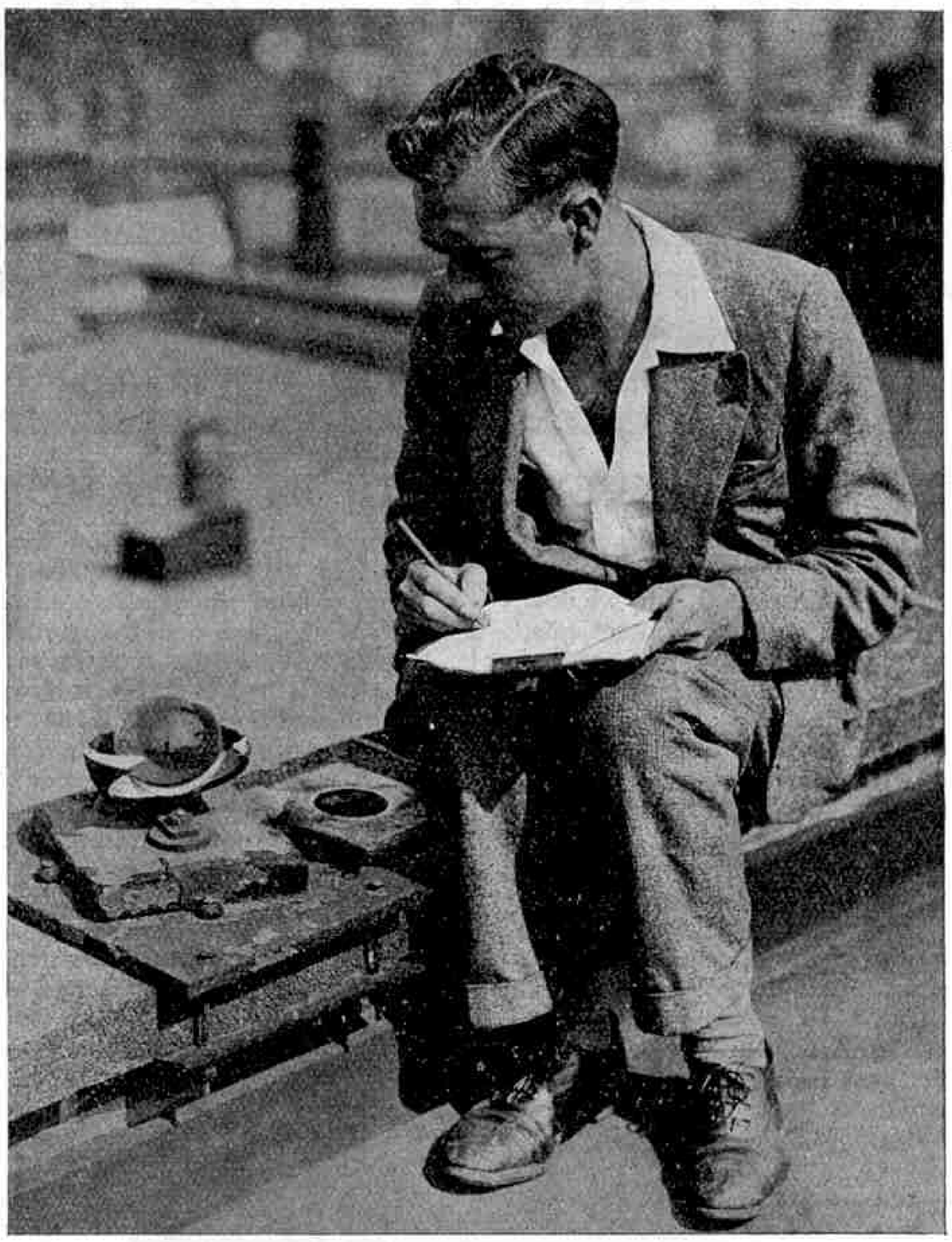
The book itself is an admirable example of the value of photography, for it includes 64 plates of remarkably interesting photographs that serve at once to show how photography is applied in many spheres in daily life, and to indicate its efficiency for the many purposes to which it is applied.

"The Wonder Book of Do You Know?"

(Ward Locke & Co. 5/- net)

All knowledge begins with the asking of questions, and modern boys and girls are very persistent in demanding explanations for the things that they see. Although these questions may appear simple, many of them are difficult to answer immediately, and there should be a warm welcome for a book such as this, which gives brief but completely satisfactory replies to an amazing variety of puzzling questions. The answers have the additional advantage of encouraging a lively curiosity that leads to other questions and answers, and the book therefore provides an easy and pleasant road to a wide general knowledge.

The questions seem to cover almost every branch of modern scientific knowledge, from astronomy and botany to zoology, physiology and simple engineering, and in addition there are others of a general type that cannot be classed in any of these divisions. What makes a glow worm glow? How does a speedometer work? What is inside the Earth? Why don't we fall off the Earth? Why are some people left-handed? These are a few of the large number of questions that are answered in short articles, illustrated with a wealth of excellent photographs that drive home the chief points of interest. In addition there are many questions grouped together and answered in a few words. These short answers are specially attractive, and as they do not appear on the same page as the relative questions, they form splendid subjects for what may be turned into an exciting game. Altogether, learning things from this volume, with its 300 half-tone illustrations and drawings, and puzzling your friends by asking them questions from it, will be great fun for its fortunate owners.



Recording the hours of sunshine. (From "The Wonder Book of Do You Know?" reviewed on this page.)

"Inside the Atom"

By John Langdon Davies
(Routledge. 5/- net)

Sooner or later every child begins to think and ask such questions as "What am I made of?" and "What is the world made of?" The answers to these questions have occupied scientists for hundreds of years, and Mr. Davies tells the story of their conclusions in simple language that makes his book an excellent introduction to the fascinations of modern science.

The author begins by showing how we came to the belief that the atoms of the elements are the building bricks of which the world is made. He explains that there are 92 kinds of these bricks, and that each unites either with others of the same kind, or with different atoms, to form molecules that are eternally dancing about, and never remain still for an instant, even when we try to crowd them together by compressing them or cooling them. For instance, the air we breathe is made of molecules that move at least 30 times as fast as the speediest express train. Similarly the pressure on the cover of a bicycle tyre is caused by the incessant hammering of the millions of tiny molecules pumped into it as they rush about inside it. The inventors of the steam engine made use of these restless particles by stirring up the molecules of water by heating them, and applying their energy to drive machinery and locomotives.

Even greater surprises come when we begin to look inside these bricks, however, for the atoms are mostly empty space. In fact, if we could squeeze together all the material within the atoms of the Earth, our globe would shrink to about the size of an orange! This seems astounding, but there is no doubt that it is true, and in the second section of his book the author explains why we now picture every atom as a minute central nucleus surrounded by one or more very tiny particles of negative electricity, called electrons, that circle round it in rings. Finally comes a section dealing with waves. Waves in the sea, and sound waves in the air, are familiar to all of us, and through these we come to the waves sent out when the electrons in atoms jump from one ring to the other, and see how they are responsible for such marvels as radio.

The book is illustrated by useful diagrams, and the story is told so attractively and simply that its readers will share the thrills of the great scientific discoveries with which it deals.

The eye of a cat. (See above.)

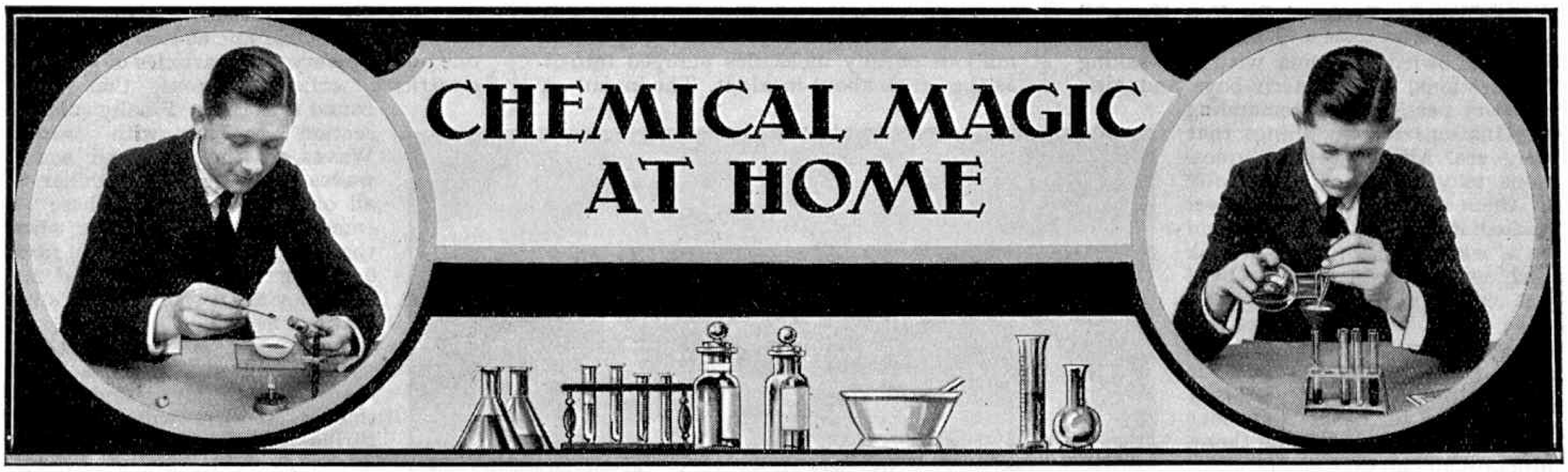
"Dust"

By S. C. Blacktin, M.Sc., Ph.D., A.I.C.
(Chapman and Hall. 18/- net)

Most of us have always accepted dust as an unpleasant evil, to be removed by vigorous action with a duster, or better still, with a vacuum cleaner. The study of Dr. Blacktin's book gives us increased respect for it, for we learn that we appear to live in an all-pervading staubosphere, or atmosphere of dust, that has encircled the Earth for millions of years, and has been continuously increased in extent. One hypothesis of the origin of life suggests that it reached our planet in dust from some cosmic source, and a reading of the book suggests that dust formation will continue to the end of the Earth.

The book is divided into two sections, one dealing generally with dust in nature and in everyday experience, and the other with special aspects of the dust problem. In the first section many amazing facts are given in regard to the production of natural dusts and their wide distribution by the wind. The second deals with dust from a scientific standpoint, explaining how dust particles in the atmosphere can be counted and their influence measured, and comparing methods of removing them from gases, either by filtering or by electrical methods similar to that described in the article on page 952 of the *"M.M."* for December, 1934. It concludes with a chapter on the unpleasant effects of dust on the human body. Alarming diseases due to various dusts are dealt with, and suggestions are made for checking their ravages by the use of respirators and improved means of ventilation. Dust also is harmful indirectly, for it robs us of much of the ultra-violet radiation of the Sun.

The contents of the book are novel, and include many startling statements that show the intense importance of dust in almost every human activity. The writing suffers from a certain lack of continuity, however, and the book might be described as a series of notes in which an immense number of facts about dust have been classified. It is illustrated by two excellent plates and several diagrams.



CHEMICAL EXPERIMENTS IN THE HOME

CHEMISTRY in the home presents an almost inexhaustible field for the experiments of owners of Kemex Outfits. In previous articles tests of foodstuffs have been described, and we now deal with interesting experiments with other household chemicals, and particularly with metals that are used for many purposes in every home.

One important use for metals is in the making of cooking utensils. For this purpose it is important to select materials that are not acted upon chemically by the acids that may be present in certain foods. The juices of various fruits often contain these active chemical agents. The best example of this is the lemon, which contains citric acid, an important and interesting organic substance. It is not difficult to separate this acid from lemon juice by cutting the ends off one or two lemons and squeezing the liquid into a basin or saucer. If necessary the juice is strained through muslin in order to remove pips or any solid matter that may be squeezed out.

Calcium carbonate in finely divided form is required for the next step in this experiment. It is best prepared by precipitation, and the product is known as precipitated chalk. Pieces of Calcium Carbonate (Marble), No. K102, are added to a test tube half filled with dilute hydrochloric acid until no further effervescence is obtained and a little of the marble remains undissolved at the bottom of the tube. At this stage the acid is neutralised and the solution contains calcium chloride. The liquid is poured into another test tube, and to it is added a strong solution of washing soda prepared by dissolving a teaspoonful of washing soda crystals in a test tube half full of water. The resulting white precipitate of calcium carbonate is separated from the liquid by filtering in the usual manner, and is washed by pouring through it successive quantities of hot water. The funnel containing the precipitated chalk is put in a warm place to dry, and the solid can then be scraped off the filter paper ready for use in this experiment.

Polishing a silver spoon with the simple polish described in the accompanying article.

Sufficient lemon juice to half fill a test tube is a suitable quantity for the preparation of citric acid. This may be allowed to remain in the test tube, or may be poured into the evaporating dish, and the dry precipitated chalk is added to it, a little at a time, until no further effervescence is produced. The gas given off is carbon dioxide, formed by the action of the citric acid on the calcium carbonate, and finally the tube or evaporating dish is found to contain a liquid and a small quantity of a white solid. This white solid is calcium citrate and it is separated from the liquid by filtering. A little water is poured through the filter paper in order to wash the calcium citrate, which then is transferred to a clean test tube, placed under the funnel, by making a hole in the bottom of the filter paper with the aid of a piece of wire or a glass rod, and washing the white solid through with about half a test tube full of water. Now add a measure of Sodium Bisulphate, No. K125, and warm gently for a few minutes. Again a precipitate, this time of calcium sulphate, is formed, and when this is filtered off, the liquid passing through the paper is found to possess an acid taste when a drop is placed on the tongue. It contains citric acid and turns blue litmus paper red.

Other fruit juices also contain acids, and these may act upon the metals of which cooking utensils are made. It is therefore interesting to test various well-known metals with acids in order to see which of them is liable to corrosion. For instance a few pieces of Granulated Zinc, No. K134, are polished as well as possible and boiled with strong vinegar. The metal becomes tarnished, and the production of small bubbles is evidence of a chemical change due to the attack of the acid. A small strip of polished zinc foil also can be used in this experiment.

Alkalies also attack zinc, and caustic soda is particularly active in this respect. A small quantity of a solution of this is prepared in the manner explained on page 28 of the No. 2-3 Kemex Manual and is heated in a test tube with Granulated Zinc broken up into small fragments. A vigorous effervescence takes place. This is due to the production of the gas hydrogen, which may be given off in such quantities that it burns when a light is applied to the mouth of the tube.

Even common salt acts chemically upon zinc when a very strong solution is used. This experiment is carried out in exactly the same manner as those already described, and the salt solution used must contain as much salt as possible. In these chemical actions the zinc of course passes into solution, and as this would lead to contamination of foodstuffs containing acids or alkalies prepared in vessels made of zinc, this metal clearly is unsuitable.

Copper is another metal that is acted upon by acids, but it is not so readily attacked as zinc, except by nitric acid, which is not met with in cooking operations! Certain other strong acid liquids dissolve it fairly readily. A solution of Sodium Bisulphate, No. K125, is made by dissolving four measures in a quarter of a test tube full of water and fragments of copper are added to the liquid. On heating a slight action takes place and part of the copper passes into solution in the form of copper sulphate. In order to show the presence of this chemical, pour off some of the liquid and add to it ammonia drop by drop. This intensifies the pale blue coloration caused by the presence of copper, and the appearance of this is a proof that the metal has dissolved.

A similar experiment can be made with vinegar in place of the Sodium Bisulphate, but prolonged boiling will be necessary and the blue colour obtained on the addition of ammonia will not be so intense, showing that copper is not so readily acted upon by this acid. Other acids, such as those present in fruit juices, have even less action upon the metal. In the case of the ripe fruits employed in making jam, there will be practically no action, for acids are absent, and that explains the use of brass preserving pans.

A metal that has come largely into use in the home in recent years is aluminium. This does not react with acids as readily as zinc, but can be corroded by vinegar. In order to test this small

pieces of polished aluminium are boiled in half a test tube full of vinegar and examined from time to time. It will be found that eventually the metal is corroded. This corrosion takes place more rapidly in the presence of salt, especially if the solution contains a large proportion of this chemical. In order to show this, further pieces of aluminium are boiled in half a test tube full of vinegar to which a quarter of a teaspoonful of salt is added. The corrosion observed in this case takes place more readily, and is more extensive than in the experiment already described.

Interesting experiments can be made with plated materials. The two chief metals used for plating household ware are silver and nickel, and the purpose of this is to provide articles with a protective covering that is not readily tarnished or corroded. In order to find whether a spoon or similar article is plated with nickel or silver it is boiled with an acid. For a test of this kind an old plated spoon should be used, and the experiment is best carried out in the evaporating dish, in which a solution made by dissolving four measures of Sodium Bisulphate, No. K125, in a third of a test tube full of water is placed. This solution is warmed and one end of the spoon is held in the hot solution for a few minutes. If the plating is of nickel, some of this will dissolve to give a solution with a pale green colour, and the absence of colour will indicate that the spoon is plated with silver. If a green liquid is obtained in this experiment, a strong solution of washing soda should be added to a portion of it drop by drop, and after the effervescence has ceased a small quantity of a green precipitate of nickel carbonate will be produced.

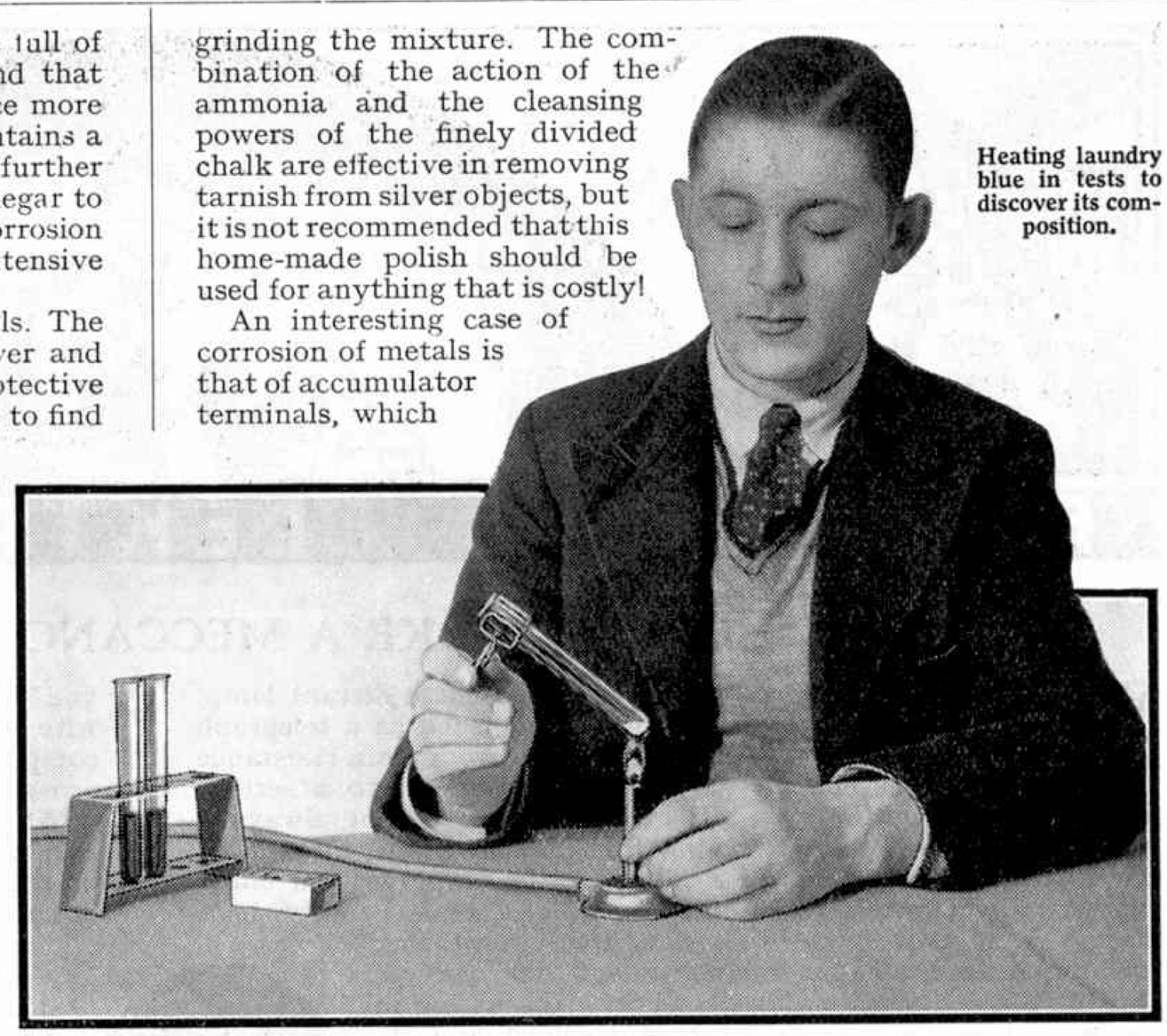
Although silver-plating is a means of protecting the spoon from corrosion or tarnish, it is not completely effective, for silver spoons and other silver articles are often blackened on exposure. This is particularly noticeable in the case of egg spoons, and the cause of the blackening is sulphur, a minute proportion of which is present in an egg. The compound produced is silver sulphide. This can be removed by means of ammonia solution, and rubbing an old blackened spoon with a cloth that has been dipped in this alkaline liquid will cause the disappearance of the black compound.

Some silver polishes make use of this property of ammonia and it is interesting to test them for this chemical. The experiment is carried out by placing a little of the polish to be tested in the evaporating dish, as shown in the lower illustration on this page, or in a test tube, adding an equal quantity of Calcium Oxide, No. K103, and covering the mixture with water before warming gently. Ammonia is then given off and can be detected either by its smell, or by its action on a moist red litmus paper held in the fumes rising from the heated liquid.

Metal polishes usually contain a very finely divided material that acts mechanically on dirt and impurities on metal objects to be cleaned. It is essential that the particles of this material should be very fine and smooth-surfaced in order to avoid scratching the metal or wearing it too quickly. A simple metal polish can be made with the precipitated chalk prepared in an experiment already described, for its particles are very small. A small quantity of it is made into a thick paste by adding to it a few drops of ammonia and stirring or grinding the mixture. The combination of the action of the ammonia and the cleansing powers of the finely divided chalk are effective in removing tarnish from silver objects, but it is not recommended that this home-made polish should be used for anything that is costly!

Testing a metal polish for ammonia by holding a moist red litmus paper in the fumes produced by boiling it with lime.

An interesting case of corrosion of metals is that of accumulator terminals, which often become coated with a sticky green solid when neglected. If any of this solid is available it provides an interesting exercise in chemical analysis. Its source must be the metal of the terminals, which are made of brass, for the only other metal present is lead, which does not dissolve in sulphuric acid. Its colour suggests that copper is present and in order to prove this a small quantity is dissolved in water and dilute ammonia is added drop by drop to a portion of the solution. If a pale blue precipitate is obtained that dissolves on further addition of ammonia, giving an intense blue solution, this is a proof that it contains copper. A further test consists of adding to another portion of the liquid a solution made by dissolving three measures of Sodium Ferrocyanide, No. K128, in a quarter of a test tube full of water. In this case a brown precipitate again indicates that the green compound contains copper, for the ferrocyanide of this metal is brown and insoluble in water, and therefore is precipitated.



Heating laundry blue in tests to discover its composition.

Further tests should be made to confirm indications of this kind. In this case a little of the green compound should be taken up on the end of a piece of asbestos, or the nickel chrome wire included in Kemex Outfits, and held in the flame. If this is coloured green, copper is present, Finally dip a clean piece of iron, such as a new nail, into the liquid, or boil a portion of it with a nail broken up into fragments. If copper is present, it will form a brown deposit on the nail in the first experiment; and a brown powder will be produced, and the liquid will lose its blue colour, in the second.

These tests prove the presence of copper in the green deposit, and it remains to find what salt of copper has been formed by the corrosion of the terminals of the accumulator. It is not difficult to see that this will be copper sulphate, since sulphuric acid is the only acid present. In order to prove this prepare a strong solution of calcium chloride by adding Calcium Carbonate (Marble) No. K102, to a quarter of a test tube full of hydrochloric acid until effervescence ceases. On adding this liquid to a solution of the green deposit a white precipitate of calcium sulphate indicates the presence of a sulphate.

Interesting analytical tests can be applied to the contents of the blue bag used for giving a good colour to white clothes when they are washed. Various substances may be present in this material. A small quantity of it is heated in a dry test tube, as shown in the upper illustration on this page. The appearance of a purple vapour shows the presence in the blue of indigo.

If no indication of indigo is obtained half a measure of the blue is dissolved in half a test tube full of water. The liquid then is shaken well after the addition of four measures of Sodium Bisulphate, and if it becomes colourless, and the characteristic smell of hydrogen sulphide, or sulphuretted hydrogen, can be detected, it is probable that the blue contains ultramarine.

If this experiment also leads to no definite result, a dilute solution of the blue is made and about a quarter of a teaspoonful of washing soda is crushed and added to it. If on warming the solution becomes brown or dark red, the change indicates the presence of Prussian Blue.

HOW TO MAKE A MECCANO ELEKTRON RELAY

WHEN an electric current is required to light a distant lamp, or work a distant electrical contrivance such as a telegraph instrument, the length of wiring necessary introduces a resistance that may be great enough to weaken the current to a serious extent. Increasing the strength of the current is not always a satisfactory means of overcoming this difficulty, and instead an interesting device known as a relay can be employed. In effect this is simply a switch, actuated by means of a weak current from a distant point, that opens or closes a circuit containing the lamp to be lighted, or the instrument to be worked, and the necessary source of electricity. The wiring in the second or "local" circuit then is short and its resistance does not cause a serious loss of efficiency.

A simple relay made from Meccano Elektron parts is shown in use for controlling a distant lamp in the illustration on this page. In construction it resembles the Elektron Electric Bell. In order to build it the Angle Yoke, No. 1547, is fixed in the position it occupies in this Bell by means of Bolts passing through the holes in its flanges and through those numbered 4 and 5 in the illustration of the Universal Base in Fig. 22 of the No. 2 Elektron Manual. A Magnet Coil, No. 1538, is mounted on the Angle Yoke, as shown in the illustration, and the ends of its winding are connected underneath the Universal Base to Terminals in holes 3 and 11. The wires from the distant source of control are led to these two Terminals, and the attractive force exerted by the Magnet Coil when current passes through them, and through the winding of the Coil, is used to close the switch that brings the local current into action. An Elektron Bichromate Cell supplies the current from the distant point, and an Elektron Switch is included at a suitable point in this circuit.

The remaining part of the relay is constructed as follows. The Armature Support, No. 1550, is fitted in hole 2 in the Universal Base, and the Bell Armature, No. 1543, is attached to it so that the end of the Armature itself is in front of the Core of the Magnet Coil. It will be seen that the Armature occupies exactly the same position as in the Electric Bell. The Connecting Link, No. 1567, is fixed at the end of the Armature, and the Bolt holding it in this position is passed through its slotted end. A $\frac{1}{2}$" Bolt is fitted in the round hole at the outer end of the Connecting Link. The Bell Contact Pillar is placed in hole 12 in the Universal Base, with its horizontal screw pointing towards the end of the bolt mounted on the Connecting Link, and Terminals occupy holes 1 and 6. To complete the relay Terminals 1 and 2 are connected by a short length of wire, and a second wire joins Terminals 6 and 12. These connections are made under the Universal Base.

The local circuit contains the Elektron Lamp and a second Bichromate Cell. It is wired by connecting one Terminal of the Bichromate Cell to one of the two Terminals on the Circular Base, and the other to the Terminal in hole 6 of the Universal Base. A wire from the Terminal in hole 1 to the second Lamp Terminal completes the circuit, except for the gap between the horizontal screw of the Bell Contact Pillar and the Bolt on the Connecting Link.

When the current from the distant source is switched on, the Armature is attracted towards the Magnet Coil. This closes the gap in the local circuit and the Lamp is lighted. If necessary the Connecting Link is bent slightly, and the position of the Bell Contact Pillar adjusted, to give a firm contact.

The Meccano Elektron relay also can be used for operating a distant buzzer, and thus lengthening the range of a miniature telegraphic system. Great use actually is made of relays working on similar principles in long distance land telegraphy. Their use enables the energy required to work receiving instruments to be derived from local sources that are not reduced in effectiveness by the resistance due to long connecting wires, and the transmission wires themselves are not overloaded, since they carry only the comparatively small currents required to operate sensitive relays. Many interesting applications can be made of the Elektron relay, and its use for long distance telegraphy, or for similar purposes will provide a wide field for ingenious Elektron owners.

Experiments in which the direction of the lines of force in magnetic fields is revealed are always of great interest. The forces of attraction and repulsion of course are exerted invisibly, but the lines along which they act can readily be demonstrated. They usually are traced with the aid of iron filings in the manner described on page 5 of the No. 1 Elektron Manual. The magnets giving the field of force to be mapped are covered by a sheet of paper or card, over which Iron Filings are scattered thinly and evenly. When the paper or card is tapped, the filings immediately arrange themselves in lines joining opposite poles, forming interesting patterns that show remarkable curves. Even the field of a simple bar magnet will be a surprise to those who know little of the working of magnetic forces, for the lines follow curved paths between the poles instead of passing straight from one to the other. The lines of force for various combinations of magnetic poles are illustrated in the No. 1 Elektron Manual, in which an easy means of securing permanent photographic records of magnetic fields also is explained.

Another interesting method of exploring a magnetic field is to place a Compass Needle at various points in it and to note the direction in which it points. In order to carry out an experiment of this kind the Compass Mount and Pivot is removed from the Compass Box, and the Compass Needle is placed on it. Suppose that the magnetic field of a single Bar Magnet is being explored. The magnet is laid on a sheet of clean paper, and the Compass Needle is placed near its north pole. The Needle immediately swings round until its south pole is pointing to the opposite pole of the larger magnet, and the positions of its ends are then marked by placing dots on the paper exactly underneath them. A line is drawn to join the dots, and this gives the direction of the line of force in the position tested.

A Meccano Elektron relay in use for distant control of an Elektron electric lamp. The construction of the relay is described in the accompanying article.

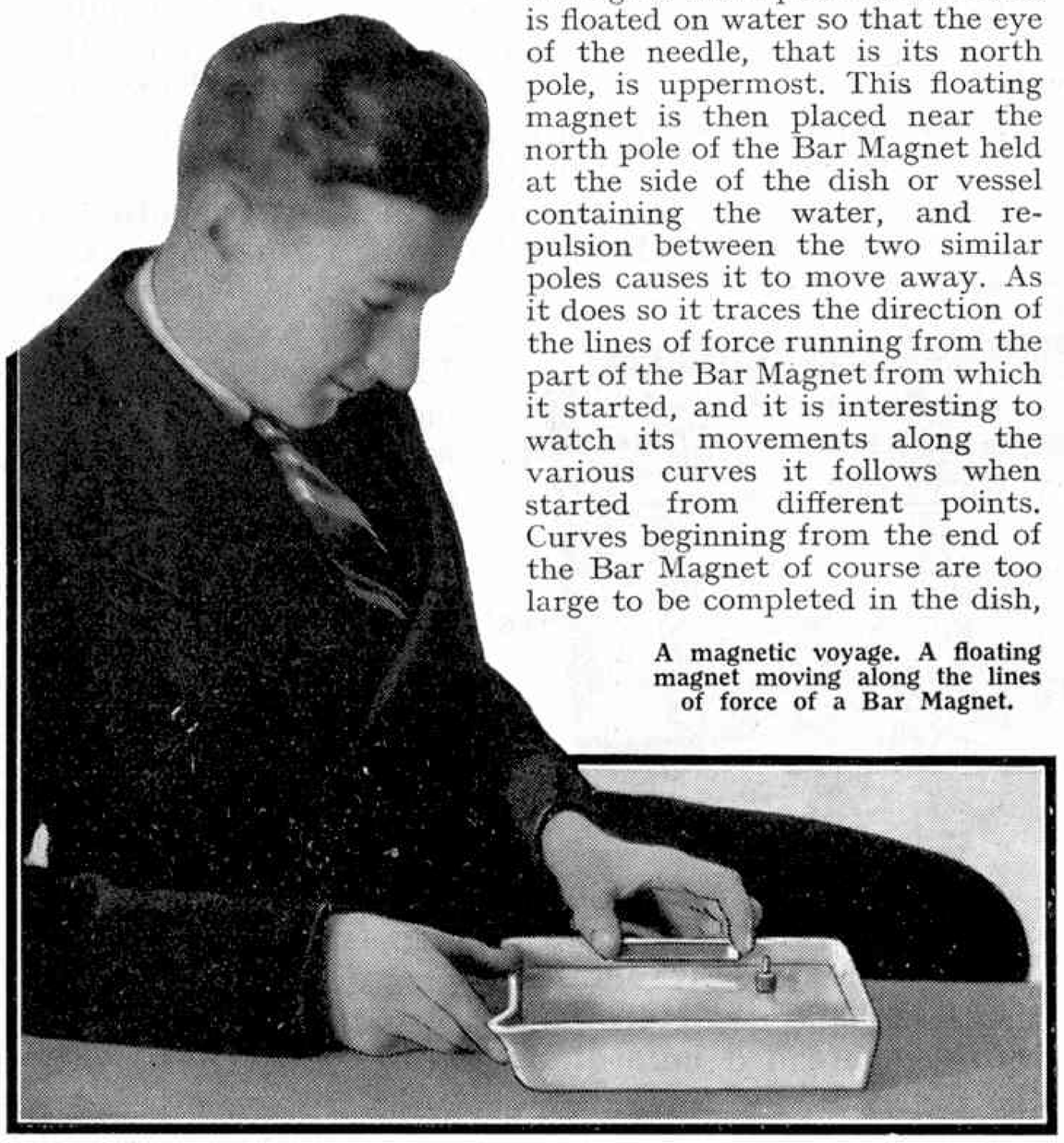
The Compass Needle is now moved into such a position that it comes to rest with its south pole exactly above the dot marking the former position of its north pole. Its position is again marked, and a second short line is drawn to indicate the direction of the line of force in the new position. The process is repeated at the outer end of the line, and this is continued. The line of force marked on the paper grows as the Compass Needle is moved into new positions, and curves round until eventually it reaches the south pole of the Bar Magnet. In order to complete the map similar lines are traced from different positions near the north pole of the Bar Magnet, and on both sides of it, and it is found that these follow the directions of those revealed by the use of iron filings.

This experiment helps to explain exactly what happens when the field of force of a magnet is mapped by means of iron filings. Every tiny particle of iron on the paper or card above the magnet acts as a compass needle and tends to set itself in the direction of the line of magnetic force passing through it. Since the filings are not pivoted or suspended, they cannot turn round until the card or paper is tapped. Then they are jerked upward and the magnetic force acts on them during the fraction of a second for which they are free to swing round in obedience to it.

The fields of force of small magnets are most quickly mapped with the aid of iron filings, but this method is difficult when dealing with very large magnets and impossible when a magnet of the size of the Earth is being examined. In order to map the Earth's field of force, therefore, the Compass Needle method is the only one that can be used with advantage. It can be used without difficulty on land, and at sea complete surveys are made in this manner in wooden ships specially equipped for the purpose. In these the use of iron and steel is reduced to a minimum in order to avoid disturbing the lines of force of the Earth's magnetic field, which would crowd into these magnetic metals. A world magnetic map is thus prepared and this shows navigators how much magnetic north deviates from true north, wherever they may be.

It is very interesting to imitate a magnetic survey of the seas on a small scale. This can be done by holding a Bar Magnet at one side of a large dish full of water, as shown in the lower illustration on this page, and finding the directions of the lines of force by means of a floating compass made by placing the Compass Mount and Pivot, supporting the Compass Needle, on a cork of suitable size. If necessary, a small weight should be fixed under the cork to make it float upright, and wherever it is placed in the water, the Compass Needle swings round to point along the line of force. The floating compass actually moves slowly towards the nearest pole of the Bar Magnet.

Swifter movement along the lines of magnetic force is obtained by substituting a magnetised needle for the floating compass. The needle is magnetised by drawing the north pole of a Bar Magnet from the eye to the point several times in succession, as explained on page 10 of the No. 1 Elektron Manual, and is then pushed through a small piece of cork that is floated on water so that the eye of the needle, that is its north pole, is uppermost. This floating magnet is then placed near the north pole of the Bar Magnet held at the side of the dish or vessel containing the water, and repulsion between the two similar poles causes it to move away. As it does so it traces the direction of the lines of force running from the part of the Bar Magnet from which it started, and it is interesting to watch its movements along the various curves it follows when started from different points. Curves beginning from the end of the Bar Magnet of course are too large to be completed in the dish,



A magnetic voyage. A floating magnet moving along the lines of force of a Bar Magnet.

but others end at the south pole of the larger magnet, to which the floating magnetic north pole is attracted.

Excellent use can be made of Elektron parts in the design of electrical accessories, and the upper illustration on this page shows a miniature railway signal that depends for its operation on the magnetic attraction of an Elektron Magnet Coil. The signal itself is constructed of Meccano parts and the Elektron Universal Base serves for the stand on which the signal is built. The post consists of two $9\frac{1}{2}''$ Strips bolted together at one end and is secured to the Universal Base by means of $1'' \times \frac{1}{2}''$ and $1'' \times 1''$ Angle Brackets. Elektron 6 B.A. Screws and Nuts are used to secure the Angle Brackets to the Universal Base. A $1''$ Screwed Rod is pushed through the second hole, counting from the bottom, of the post and is fixed in position by nuts. It passes also through holes in the Angle Brackets, and $2''$ Strips supported on its projecting ends clamp an Elektron Magnet Coil in a vertical position, as shown in the illustration. The $2''$ Strips are made to grip the Magnet Coil by screwing down nuts on a Screwed Rod passing through the holes at their ends. The windings of the Magnet Coil are connected to two Terminals, fitted at the end of the Universal Base, by means of wiring under the Base itself.

A miniature railway signal operated by means of an Elektron Magnet Coil. The Signal Arm is pulled down when current is passed through the winding of the Coil.

A $3''$ Strip is mounted on a $\frac{3}{8}''$ Bolt passing through the sixth hole of the post. The $3''$ Strip is placed between the vertical Strips, and at one end is connected to a Gong Pillar, which hangs down inside the Magnet Coil, by means of a $1''$ Triangular Plate and an End Bearing. The threaded portion of the Gong Pillar is secured in the End Bearing by means of two Grub Screws.

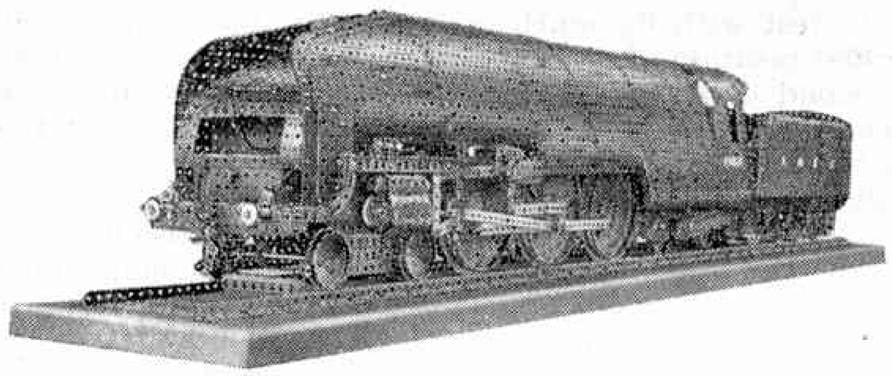
The Signal Arm is carried on a $\frac{3}{4}''$ Bolt in the third hole from the top of the post. On the opposite side of the Strips is a Double Arm Crank, carried on the same $\frac{3}{4}''$ Bolt, and this is connected to the $3''$ Strip by means of a $5''$ Rod and an End Bearing, as shown in the illustration. A Strip Coupling is mounted on the free end of the $3''$ Strip to serve as a balance weight.

The working of the signal is very simple. Wires connect the Elektron Bichromate Cell with the terminals on the Universal Base, and a Switch is included in the circuit. As soon as current is switched on, the Gong Pillar is pulled down into the Magnet Coil, and this movement causes the Signal Arm to be lowered. The counterweight restores the Signal Arm to its ordinary position immediately the current is switched off. On an actual miniature railway the Bichromate Cell can be covered with a box to represent a power house, or placed underneath the table or shelf on which the track is laid.

Owners of Hornby Electric Railways can make excellent use of the relay described earlier in this article, if this is altered slightly. The Bell Contact Pillar is placed in hole 7, instead of hole 12, and the Connecting Link on the end of the Armature is removed. The horizontal screw of the Bell Contact Pillar is turned to make contact with the brass spring of the Armature, and the effect of passing a current through the winding of the Magnet Coil is to break this contact. In this form the relay can be used to cut off current from an insulated section of an electric railway while a train occupies the track ahead of it. One of the feed wires of the protected part of the track must include the winding of the Magnet Coil, and the connections to the other section form the "local" circuit of the relay.

1 in. Scale Meccano Model of

L.N.E.R. High-Pressure Locomotive "No. 10000"



LAST month we completed our description of the construction of the Meccano model of the L.N.E.R. locomotive "No. 10000." This month we describe the construction of the tender that accompanies the locomotive. This is a scale reproduction of a standard L.N.E.R. tender, and the parts required to build it were included in the list given at the foot of page 36 of the January "*M.M.*"

Each side of the main frames of the tender consists of an 18½" Angle Girder fitted with four 12½" Flat Girders by means of which the frame is made 1½" in depth. Each end of the frame is fitted with a 2½" Strip, the lower ends of which form wheel guards. The two side frames when completed are joined together by two girders 65 and 66, each of which consists of two 5½" Angle Girders overlapping five holes. Two 7½" Angle Girders 67 are also fitted, the right-hand ends of which are secured to an 18½" Angle Girder 68. It will be noticed that the Girders 65 and 66 overhang the side main girders for a distance of ½", and to these lugs are secured two 18½" Angle Girders 69. Each of these Girders carries one of the tender sides.

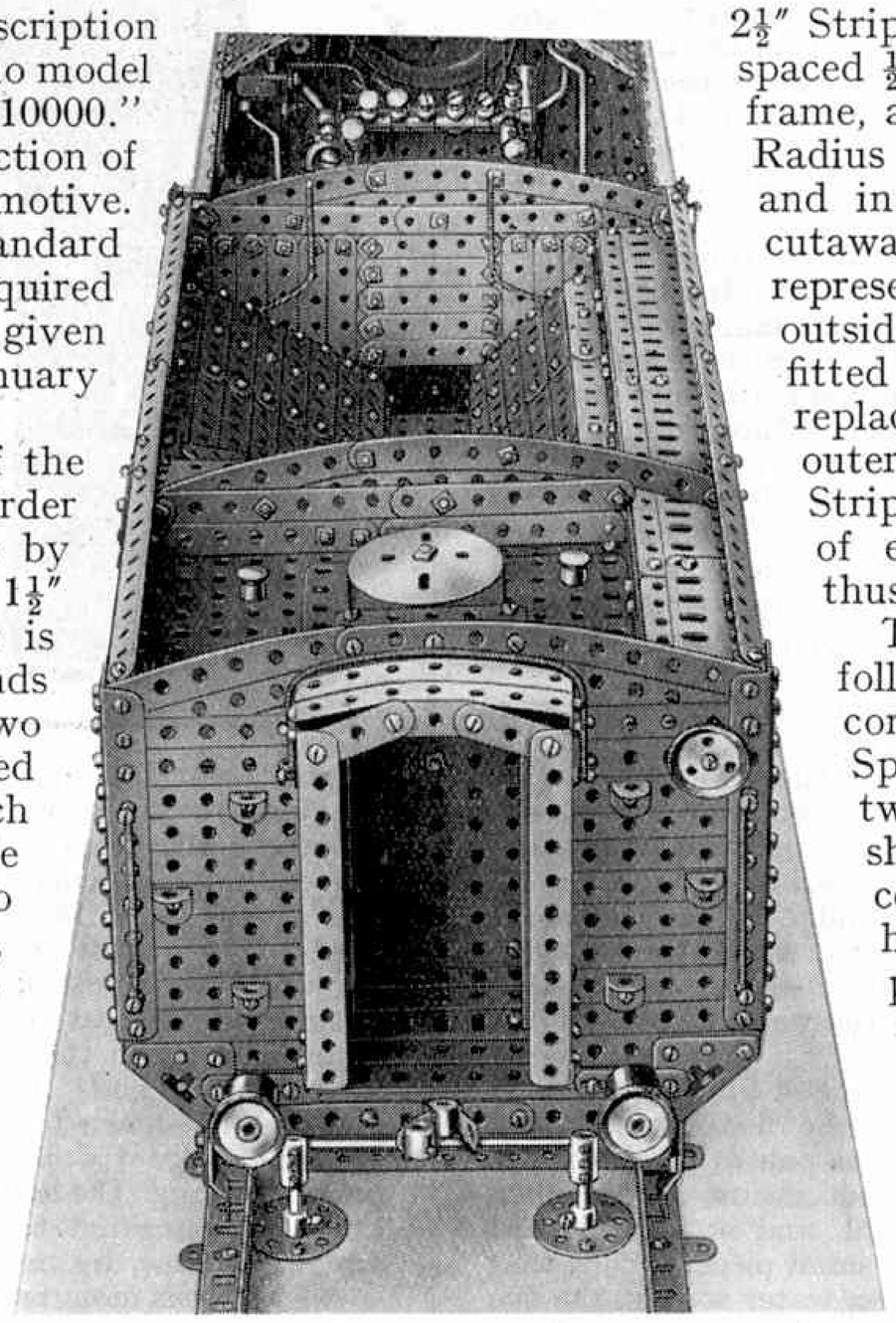


Fig. 1. The tender coal-bunker and corridor-entrance are shown in this illustration.

Each tender side is built up on two vertical Angle Girders, a 5½" at the rear end and a 4½" at the front end. Eight 18½" Strips, each composed of one 7½" and one 12½" Strip overlapping three holes, are now secured between the two Girders, and two 5½" Strips are then fixed in place in order to keep level the various strips forming the side. The two Strips are indicated at 70, Figs. 2 and 4, by the rows of bolt heads. A further strip, ½" shorter than those forming the tender side, is now fitted to the top of each wall of strips, and above this is secured the coal rail, built up from one 7½" Strip and one 9½" Strip. These two Strips overlap four holes, and the complete length is held in place by means of four Flat Brackets bent to the required shape.

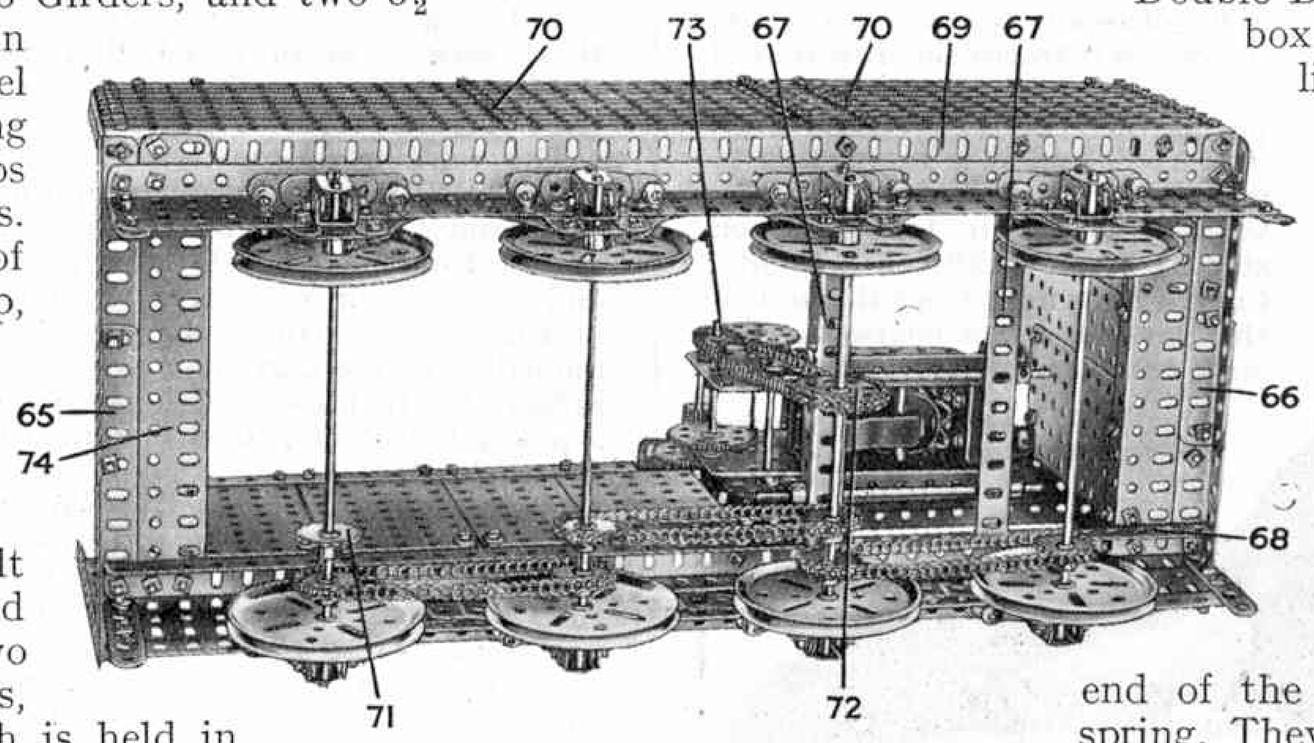


Fig. 2. An underneath view of the tender.

Before proceeding further with the construction of the tender the axle-boxes and frames should be fitted. Eight 2½" Strips are first bolted in place, in pairs spaced ½" apart, on each side of the tender frame, as shown in Fig. 2. Next 2½" Small Radius Curved Strips are secured in place, and in this manner the typical curved cutaway portions of an actual tender are represented. It should be noted that the outside Strips of each end pair are not fitted with Curved Strips, these being replaced by 3" Strips bolted at their outer ends to the wheel guards. A 1½" Strip is now secured across the bottom of each pair of vertical 2½" Strips, thus completing the axle-box frames.

The axle-boxes are built up in the following manner, the same method of construction being used for each. Each Spring consists of two 2½" Strips and two ½" Strips, bent to the required shape and secured together in the centre by a ⅜" Bolt. This Bolt also holds in place a Double Bracket, placed transversely across the spring, and also two 1"×½" Angle Brackets. These Angle Brackets are arranged in the form of a Single Bent Strip, and the two 1" lugs are arranged at 90 deg. to the two lugs of the Double Bracket already mentioned. A second Double Bracket is now bolted across the ends of the 1"×½" Angle Brackets, and the centre hole of this forms a bearing for one side of one of the axles carrying the travelling wheels. A Flat Bracket is now locknutted to the outside lug of the first-mentioned Double Bracket, forming an axle-box cover. It is removed by lifting the free end of the Flat Bracket until it is clear of the end of the axle, and then swinging it to one side. If it is thought necessary, Double Arm Cranks may be fitted in order to increase the bearing surfaces of the axles.

The complete axle-box is fitted to the tender frame by passing ½" Bolts through each end of the 2½" Strips forming the spring. They are then screwed into Handrail Supports, fixed securely to the frame, and locked in position by Grub-Screws passed into the threaded bore of the Handrail Supports from the opposite side to the ½" Bolts.

When all the axle-boxes are complete and in position the wheels and axles are fitted. Each axle consists of an 8″ Rod on which are carried two 3″ Pulley Wheels. Although these Pulleys are not technically correct, having grooves instead of flanges, they are almost the required size, and for this reason they have been used in preference to Wheel Flanges and Face Plates. The drive to the various wheels is arranged as shown in Fig. 2, the 1″ Sprocket Wheel 71 being used for connecting the tender to the engine when they are mounted together on a base-board. In addition to the 1″ Sprocket Wheels, one of the axles carries a 1½″ Sprocket Wheel 72, driven by Chain from the Electric Motor.

The motive unit consists of a No. E6 Electric Motor, to each flange of which is bolted a 3½″×½″ Double Angle Strip. These Double Angle Strips are held in place on the Girders 67 by passing 4½″ Rods through their ½″ lugs, and also through suitable holes in the Girders. This method of construction enables the motor to be taken out periodically for cleaning purposes without the manipulation of Nuts and Bolts in awkward positions. The drive is taken from a ½″ Pinion on the armature shaft to a 57-teeth Gear mounted on a 2″ Rod. This pair of gears is followed by three similar pairs, the total reduction being 81 : 1 between the armature shaft and the 3″ Rod 73. This Rod carries a ¾″ Sprocket Wheel that is connected by a length of Sprocket Chain to the Sprocket Wheel 72.

The rear door and corridor are now built. A 5½″ Flat Girder 74 is first bolted in place, as shown in Fig. 2, one end of which is held down by one end of a 9½″ Angle Girder carrying the 4½″×2½″ Flat Plates forming the inner wall of the corridor. There is no need to make a complete inner wall for the corridor as the space will be covered in later when the top of the tender is fitted. The tops of the 4½″×2½″ Flat Plates are all joined together by a 12½″ Angle Girder, which is extended by a 3½″ Angle Girder to a length of 16″. An Angle Girder 75 forms the necessary connection between the two girders.

The top of the corridor is built up from two 12½″ and two 5½″ Flat Girders as shown in the illustration. The back of the corridor leading to the door is built up from a 4½″×2½″ and a 5½″×2½″ Flat Plate, which are bolted at their lower ends to a 5½″ Angle Girder attached in turn to a 5½″ Flat Girder. This Flat Girder is attached by a similar part, to the girder 65 of the tender frame. The side and top of this part of the corridor are built up from 5½″, 2½″ and 1½″ Flat Girders as shown in the illustration.

The rear of the tender, which is shown in Fig. 1, is formed at each side of the doorway from 3″ Strips, and the curved top is represented by two long curved strips built up from four 5½″ Curved Strips. The corridor connection sides consist of 5½″ Angle Girders and Flat Girders, and for the top and bottom 3½″×½″ Double Angle Strips are used. The curve at the top of the corridor connection is represented by three 1½″ Strips bolted together as shown. Three handrails are fitted to this part of the tender, one at each side and one over the corridor connection. These consist of Spring Cord with copper wire passed down the centre, the ends being secured to ⅜″ Bolts each attached by two Nuts to the model.

Other fittings include a window, represented by a 1″ loose Pulley, and three steps on each side of the doorway, consisting of ½″×½″ Angle Brackets. Buffers are built up from 1″ fast Pulleys mounted on 1½″ Rods carried in the bosses of Double Arm Cranks secured to the main frame. The body of each buffer is represented by a Chimney Adaptor. The automatic coupling will be seen from Fig. 1.

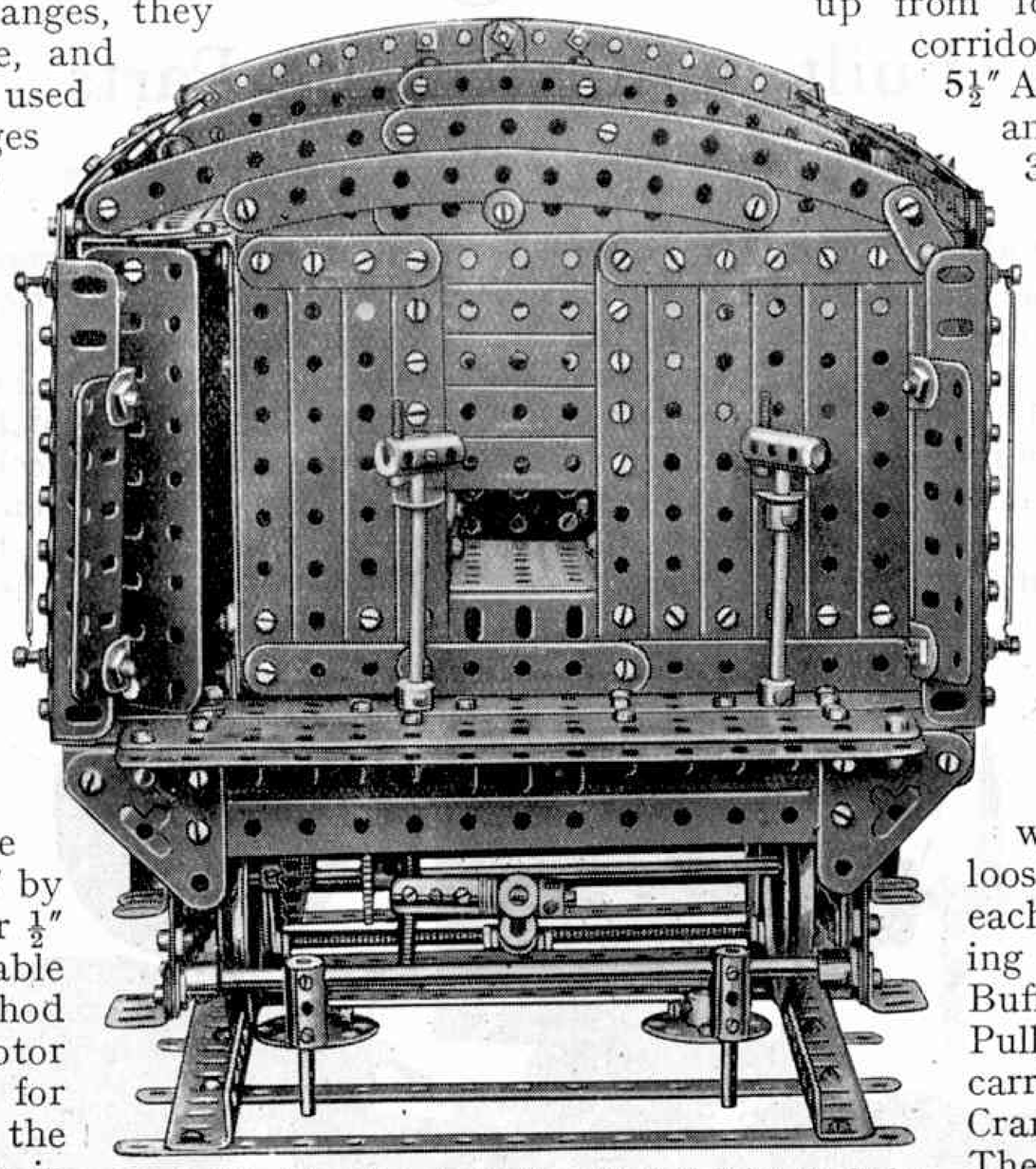


Fig. 3. This illustration shows the method of fitting the brake mechanism.

The front of the tender is shown in Fig. 3, and no description is necessary for its construction. The corridor door consists of a 4½″ Flat Girder mounted on two Hinges, and the side doors for the foot-plate are represented by 3″ Flat Girders made to swing on Hinges. Two dummy handles are fitted on the foot-plate both of which are shown in the illustration. If so desired one of these handles may be made to work brakes operating on the eight wheels of the tender, and a simple method of accomplishing this is shown in Fig. 3.

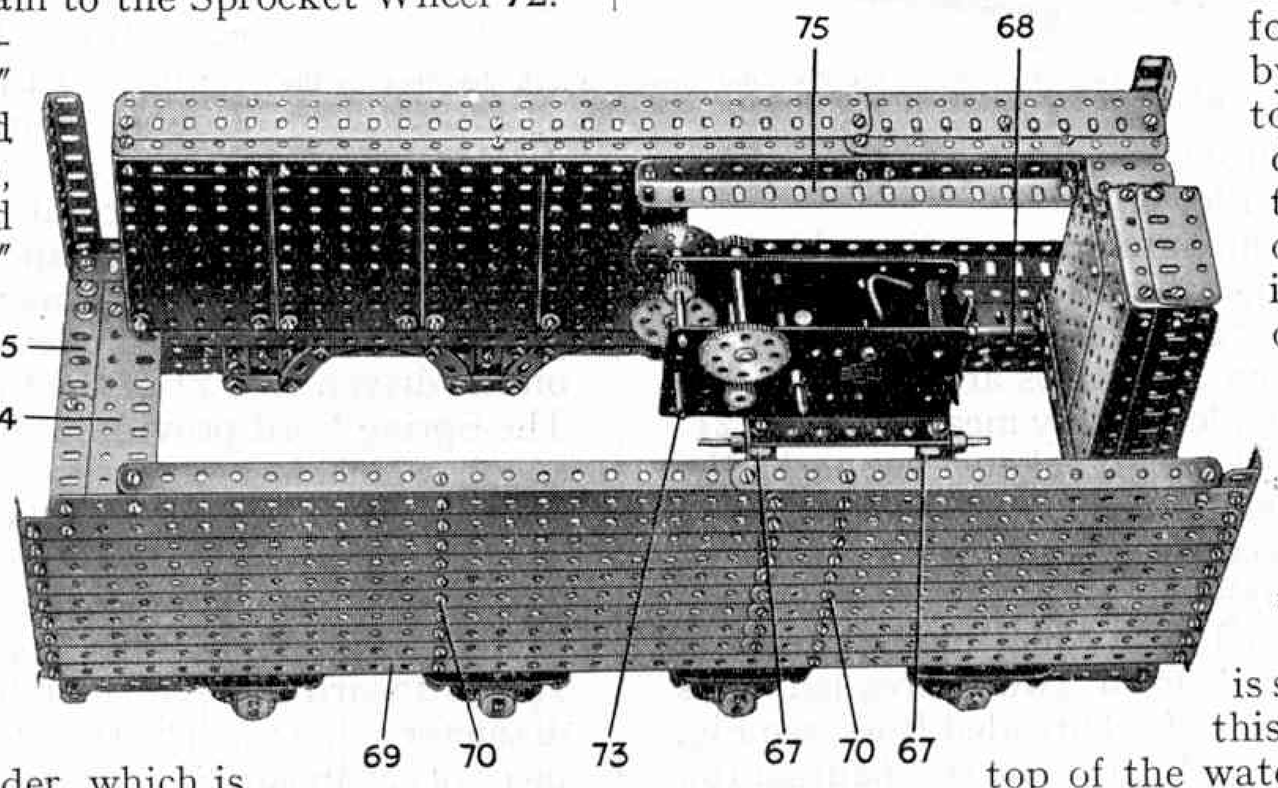


Fig. 4. The driving unit fitted inside the tender.

The top of the tender is shown in Fig. 1, and from this it will be seen that the top of the water tank is built up from 4½″×2½″ Flat Plates at its rear end, and from two 3½″×5½″ Flat Plates at its fore end. These latter Plates are bent at their centres to an angle of about 45 deg., and when they are fitted in place their lower edges are extended to the bottom of the tender by further 5½″×3½″ Flat Plates. The bottom of the tender is filled in by 5½″×3½″ and 5½″×2½″ Flat Plates, secured to the tender sides by ½″×½″ Angle Brackets. The sides of the coal compartment are built up from various sized Strips, ½″×½″ Angle Brackets being used for securing them in place.

(*Continued on page 186*)

Home-Made Moving Picture Projector

Built with Meccano Parts

IN this article we describe a working cinematograph for projecting standard films that has been designed by Mr. Bihn, of Paris, a keen model-builder. With the exception of the feed sprocket and the condenser and lens, the machine is constructed from Meccano parts, and it should be of considerable interest to other model-builders who wish to attempt models of this kind themselves. It is not an easy matter to construct a cinematograph with Meccano owing to the very delicate nature of the mechanism, but Mr. Bihn has been highly successful in overcoming difficulties, and we understand that his machine operates very satisfactorily.

The chief difficulty in building a model cinematograph lies in the intermittent motion mechanism. Usually this takes the form of the well-known Maltese cross movement, but although this is the most popular type of mechanism for the purpose, there are several other satisfactory methods of imparting an intermittent movement to the film. One of these is known as the "claw" mechanism, and it is this type that is used in the machine described here. The mechanism is built up entirely from Meccano and is shown in Fig. 4.

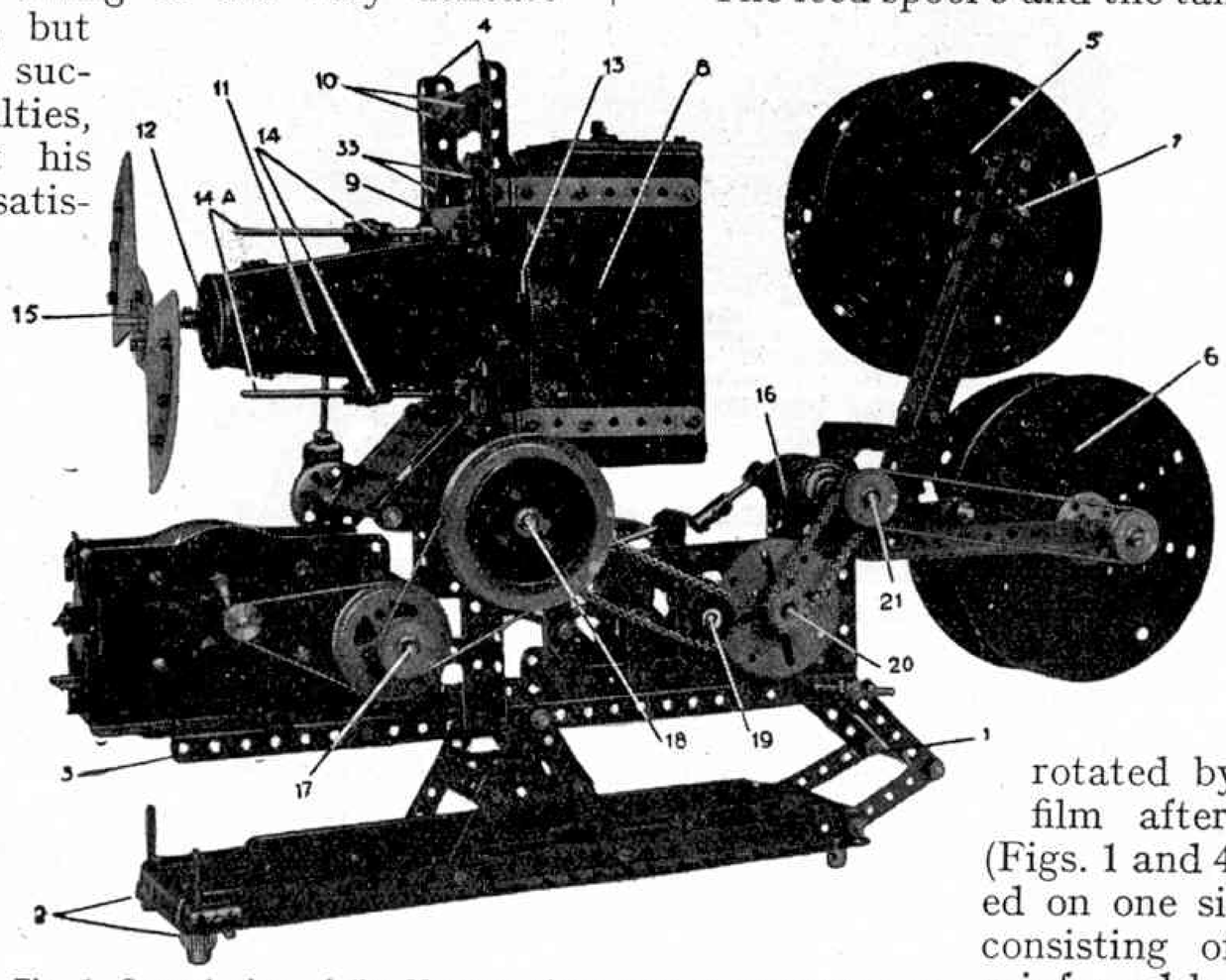


Fig. 1. General view of the Meccano cinematograph described in the accompanying article. It was designed and buil by Mr. Bihn, Paris.

The projector proper is mounted on an adjustable base $12\frac{1}{2}''$ long and $9\frac{1}{2}''$ wide, which is made from Angle Girders and strengthened by $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates. Two A-shaped brackets made from $3\frac{1}{2}''$ Strips are bolted to the sides of the base and are made rigid by means of $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Double Angle Strips. These brackets support the projector as shown in Fig. 1.

The pantagraph arrangement 1 enables the projector to be tilted to suit the height of the screen, and the projector can be securely locked in any position by means of two butterfly nuts formed from two Threaded Pins screwed into the lateral holes of a Threaded Boss (see Fig. 2). The nuts tighten the $3\frac{1}{2}''$ Strips of the pantagraph against the Angle Girder 5, on the inside of which is a Threaded Boss provided with a set screw. The small legs 2 at the front of the base are adjustable. They are each formed from a $\frac{1}{2}''$ Pinion on a 2" Screwed Rod, and can be screwed or unscrewed freely in one of the tapped holes of a Coupling fixed to the base.

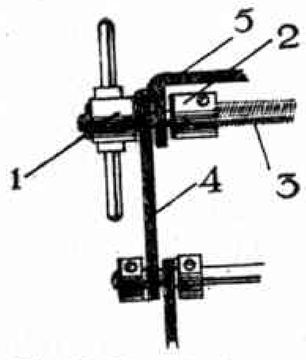


Fig. 2. Detail of the locking device for the projector stand.

The chassis of the actual projector is formed from two $12\frac{1}{2}''$ Angle Girders 3 (Fig. 1), which support the mechanism, the feed and take-up spools 5 and 6, the two uprights 4, and the Meccano Electric Motor that drives the model.

The uprights 4 each consist of a $5\frac{1}{2}''$ and a $9\frac{1}{2}''$ Angle Girder and are shown in Figs. 1 and 4. They support the principal shaft 18, which works the shutter and the intermittent motion mechanism, the lamphouse 8, the film gate 9 and the lens housing 11, which in turn supports the spindle for the shutter.

The feed spool 5 and the take-up spool 6 are each made from two 6" Circular Plates spaced apart by a Sleeve Piece fitted with two Chimney Adaptors, the complete assembly being mounted on an Axle Rod. A small Pulley Wheel with centre boss and set screw is fitted to one side of the spool thus formed, and a Bush Wheel to the other. The Rod of the feed spool 5 carries a small crank handle 7, formed from a Coupling and a short Rod, which enables the spool to be rotated by hand for re-winding the film after it has been projected (Figs. 1 and 4). The feed spool is attached on one side only to a support arm consisting of two $7\frac{1}{2}''$ Angle Girders reinforced by two $5\frac{1}{2}''$ Angle Girders. A Double Arm Crank is bolted to the Angle Girders to provide a bearing for the axle of the spool.

The take-up spool 6 rotates on a Rod held between a pair of $5\frac{1}{2}''$ Angle Girders, and a Pulley Wheel on the end of the Rod is driven by means of Spring Cord, which passes round a second Pulley of the same diameter fixed on the driven Rod 21 of the take-up sprocket (see Fig. 5). The Spring Cord provides a friction drive to the take-up spool, which is necessary on account of the increasing diameter of the film on the take-up spool during projection.

The lamphouse 8 (Fig. 1) is hinged to the uprights 4, and its sides consist of Flanged Plates, while the back is a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. The front is composed of one $5\frac{1}{2}'' \times 2\frac{1}{2}''$ cardboard plate in the middle of which a hole $1\frac{1}{2}''$ in diameter is bored. The top of the lamphouse consists of a piece of cardboard $2\frac{1}{2}''$ square, which supports an ordinary bayonet type lamp socket for the projection lamp. When the machine is in use a Hinge fixed to one of its lower front corners (see Fig. 4) keeps the lamphouse closed tightly against the film gate, just sufficient space being left for the film to move

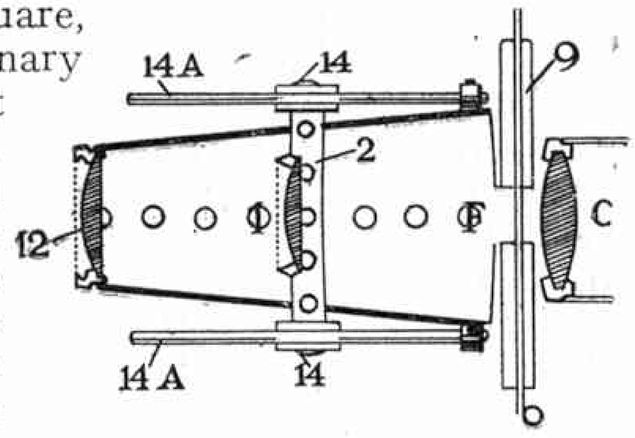


Fig. 3. Diagram of the lens housing, showing positions of the lenses and the focussing arrangement.

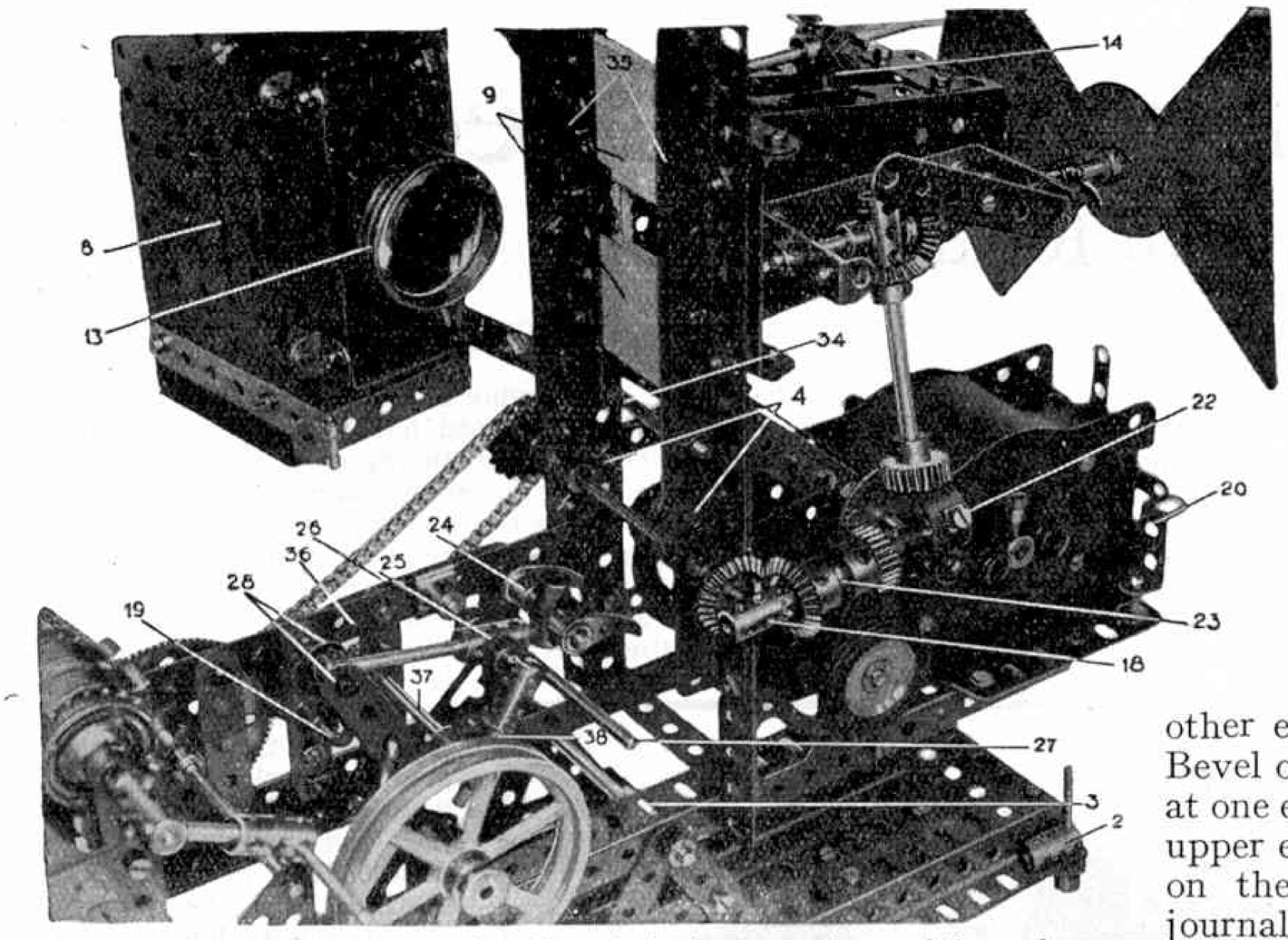


Fig. 4. A close-up of the mechanism. The gate is shown open to reveal the condenser.

freely between the condenser and the inside surface of the gate. The inside of the lantern is covered with thin stout cardboard, but sheet tin would be better and would be quite easy to fix in place.

The film gate 9 (Fig. 4) is formed with two pieces of stiff cardboard $2\frac{1}{2}$" in width and $3\frac{1}{2}$" in length. A hole $\frac{3}{4}$" wide and 1" long is cut in the centre of each piece of cardboard. Between them are placed two $5\frac{1}{2}$" Strips 33 (Fig. 4), which space the cards about $\frac{1}{8}$" apart. At the bottom of the gate a 2" guide Rod is fixed between the two vertical Strips and the two Angle Girders 35. The Angle Girders 35 enable the gate to be bolted to the two uprights 4. The guide roller 10 (Fig. 1), over which the film passes from the feed spool into the gate, is composed of two $\frac{3}{4}$" Flanged Wheels mounted on a 3" Rod fixed between the uprights 4.

The optical system is shown in diagrammatic form in Fig. 3. The condenser C is a bi-convex lens, and is held in position over the hole in the lamphouse by means of two $3\frac{1}{2}$" Strips. The focussing device and the projection lens holder consists of two Flanged Sector Plates spaced by four $1\frac{1}{2}$" Strips. Between the Plates two lenses are fitted as shown in Fig. 3. Each of the component glasses is of the plano-convex type. The front lens 12 is 1" in diameter and is fixed, but the rear lens 14, which is $1\frac{1}{2}$" in diameter, is mounted so that it can be moved backward and forward for focussing the picture. It is held between two $3\frac{1}{2}$" Strips, the ends of which are fitted with Couplings that slide on the Rods 14A on each side of the housing. The focal length of the combined lenses is 2". For the condenser a bi-convex glass about 2" in diameter is used and it is mounted as shown in Fig. 3.

Constructors who have difficulty in obtaining separate lenses of the exact types and sizes used by Mr. Bihn will probably find it easier to buy a standard projection lens already mounted in a metal tube. In this case they should obtain an achromatic cinematograph objective of about 2" focus for use with standard film, from one of the dealers in cinematograph supplies who advertise in the "*M.M.*" It would not be difficult to adapt the machine for use with a standard lens housing in place of the built up Meccano housing.

The shutter of Mr. Bihn's machine is made from cardboard in the following manner. A 3" radius circle was drawn on the cardboard with a pair of compasses and then a second circle of about 1" radius was drawn concentric with the first. Finally two diagonals were drawn so as to divide the circle into four equal segments. Two opposite segments were then cut away, leaving the centre disc intact. The shutter is bolted to a Bush Wheel and each blade is reinforced by bolting to it two $2\frac{1}{2}$" Strips and two $2\frac{1}{2}$" Curved Strips.

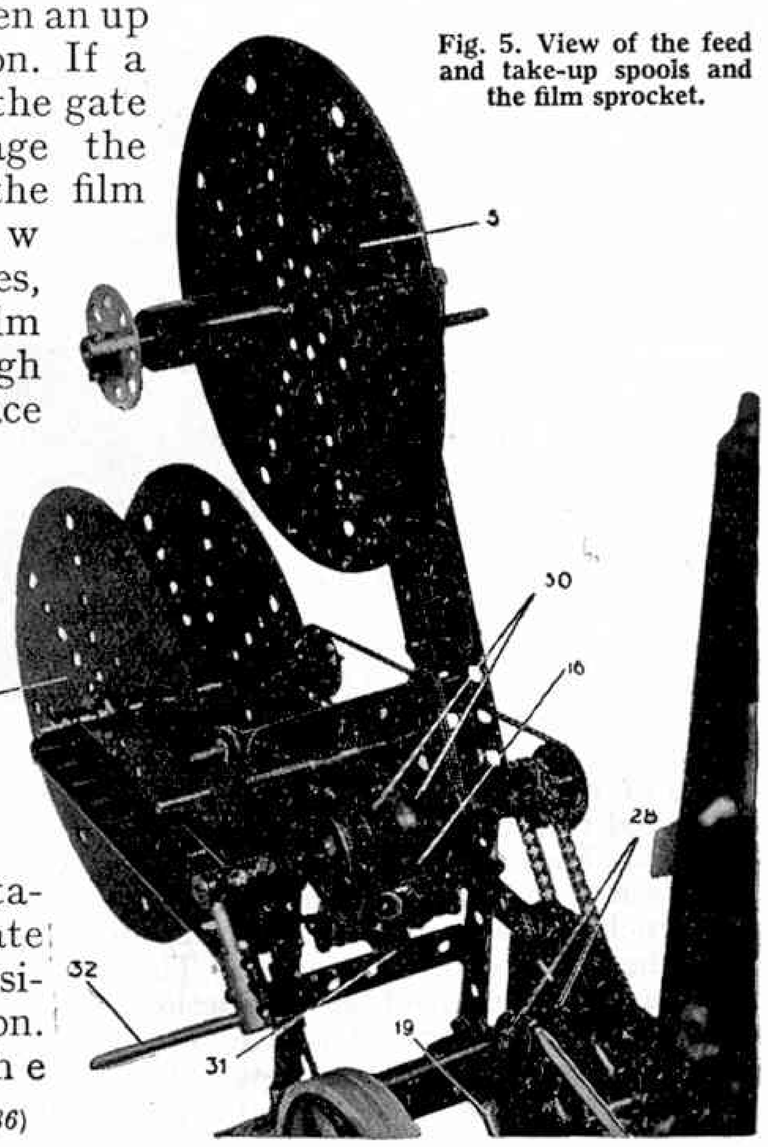
The mechanism for operating the shutter is shown in Fig. 4. The gear unit 23 is made up with a Bevel, a Socket Coupling and a $\frac{3}{4}$" Pinion, and is free to rotate on its shaft, which is supported by Strips attached to the uprights 4. It will be seen that the drive is transmitted from the Contrate to the shutter shaft by means of a Pinion on a $3\frac{1}{2}$" Rod, on the other end of which is a Bevel that engages another Bevel on the shutter shaft. The $3\frac{1}{2}$" Rod is journalled at one end in a hole of a bent Strip as shown, and at its upper end in the bore of a Coupling that is supported on the shutter shaft itself. The shutter shaft is journalled in Double Angle Strips fixed to one of the Sector Plates of the projection lens housing.

The most interesting part of the mechanism is the intermittent motion device. This, as already stated, is based on the claw principle adopted in some professionally made projectors. In this system the film is pulled through the film gate picture by picture by means of claws, which engage the perforations in the sides of the film. In the machine described here the claws are represented by Pawls, which are fixed on a $1\frac{1}{2}$" Rod. The Pawls are held by a Coupling 24 (Fig. 4) mounted on a 1" Rod, which passes through the bore of a Coupling 25, supported as shown in the illustration. The Coupling 25 carries a short Rod, at one end of which is a Collar that is pivotally connected to two $1\frac{1}{2}$" Strips. The other ends of the Strips are loosely mounted on a Crankshaft that carries a Flywheel.

The claw assembly is arranged to slide backward and forward on a guide Strip at one side of the machine, and when the machine is in motion the Crankshaft rotates and the claw assembly moves to and fro, while at the same time the Pawls are given an up and down motion. If a film is placed in the gate the Pawls engage the perforations in the film as the claw assembly advances, and pull the film downward through the gate the space of one picture. As the motion of the Crankshaft continues, the claw assembly begins to move backward, and the Pawls disengage the film, which then remains stationary in the gate in the correct position for projection. Actually the

(*Continued on page 186*)

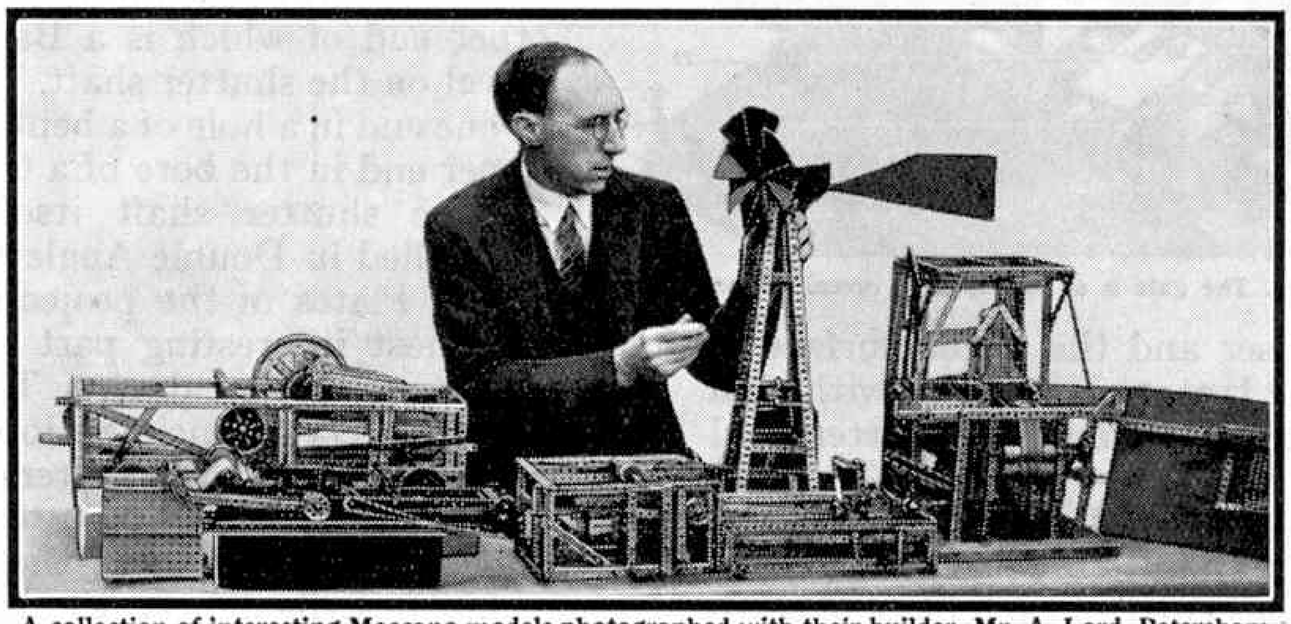
Fig. 5. View of the feed and take-up spools and the film sprocket.



Textile Machinery in Meccano

An Australian Reader's Models

THE illustrations on this page show some interesting working models that have been constructed by Mr. A. Lord, of Petersham, Australia. Mr. Lord is chiefly interested in the construction of models of textile machinery, and he has many fine examples of this type to his credit. Some of his outstanding models are a spinning mule, a carding engine, a wool scouring machine and a loom, all of which are shown in the upper illustration on this page, together with a model windmill pump, electric truck and a right angle drive mechanism. Each of these models possesses many points of interest to serious constructors, but it is possible here to describe briefly only the most outstanding. The models are not constructed entirely of Meccano standard parts. In some cases the Meccano parts used have been bent or otherwise altered, and in other instances materials other than Meccano have been used.



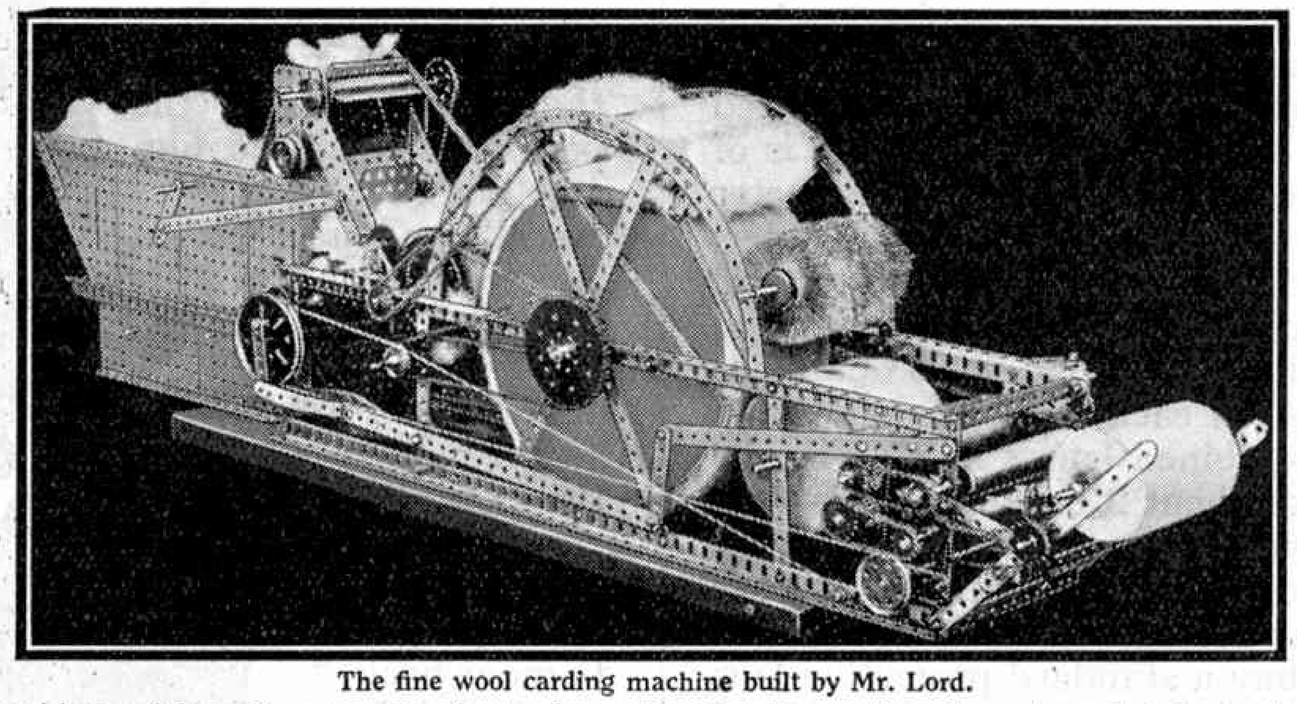
A collection of interesting Meccano models photographed with their builder, Mr. A. Lord, Petersham, Australia. They include a wool scouring machine, spinning mule, carding machine, loom, windmill pump and a novel right angle drive mechanism. Some of the models are described on this page.

The model wool scouring machine is shown in the left foreground of the upper illustration. This model carries out the operations of feeding raw and dirty wool into a tank of hot soapy water, cleansing or scouring, and then squeezing the water from the scoured wool.

The raw wool is placed in a specially shaped hopper from which a spiked feed sheet feeds it into the machine itself, the supply of wool being kept constant by means of a beater made from sheet brass. A roller fitted with four flaps made from kangaroo hide brushes the wool off the spikes of the feed sheet, and then a special fork comes into operation and immerses the wool in the hot cleansing liquid. There are two of these forks, and they work alternately, so that as fast as fresh supplies of dirty wool are passed into the liquid, the wool already in the tank, and which has been thoroughly cleansed, is brought into contact with the second fork, which lifts it from the tank. The cleansed wool is removed from the fork by means of a set of prongs carried at the ends of arms fitted to a revolving hub. These prongs deliver the wool to a second spiked feed sheet that feeds it to a set of rollers, which remove most of the water.

The model shown in the lower illustration is a reproduction of an actual carding engine used to straighten out the raw wool fibres and then condense or twist them into coarse thread.

The raw wool enters the machine from a specially shaped hopper built from Angle Girders and Flat Plates. From here it is fed by means of a feed plate provided with spikes to the first of a series of rollers. The wool is carried round a large drum and is subjected to the combing action of a number of stiff wire brushes, which are known in the wool industry as "workers" and "strippers." The former are driven from one of the feeding rollers by means of Sprocket Chain, and in turn they drive the large drum shown near the outlet end of the model. This roller, or "doffing ring" as it is named, is grooved, and its action is to separate the wool and twist it into the form of coarse thread. The strippers are driven by a belt from a wooden pulley wheel attached to the other side of the large drum. The thread finally is pulled through a series of rollers and collected on a revolving drum.



The fine wool carding machine built by Mr. Lord.

Probably the finest model Mr. Lord has built is the spinning mule. This carries out all the essential functions of a real machine, and is shown in the centre of the upper illustration. Real spinning mules are employed to twist the coarse thread or slubbing made by the carding and condensing machines to increase its strength, and to give it a tighter and smoother outward appearance.

Mr. Lord's model is capable of performing 96 draws on one filling. That is, the travelling carriage on which the flyer is mounted is able to move up and down the length of the machine 96 times before the machine needs refilling. The length of a draw is 8 in., so that the model is able to handle 64 ft. of slubbing at a time. The carriage is operated by rack and pinion mechanism. The thread is wound evenly on the flyer by means of a balanced arm fitted with a guide wire. This arm is operated by a cam, and moves slowly up and down the flyer, distributing the thread evenly.

An interesting feature of the model is that it is fitted with a rewinding mechanism so that it may be run continuously for display purposes. When the supply of thread is exhausted, the machine reverses and winds the thread back on to the feed bobbin. Then the operation of spinning is repeated.

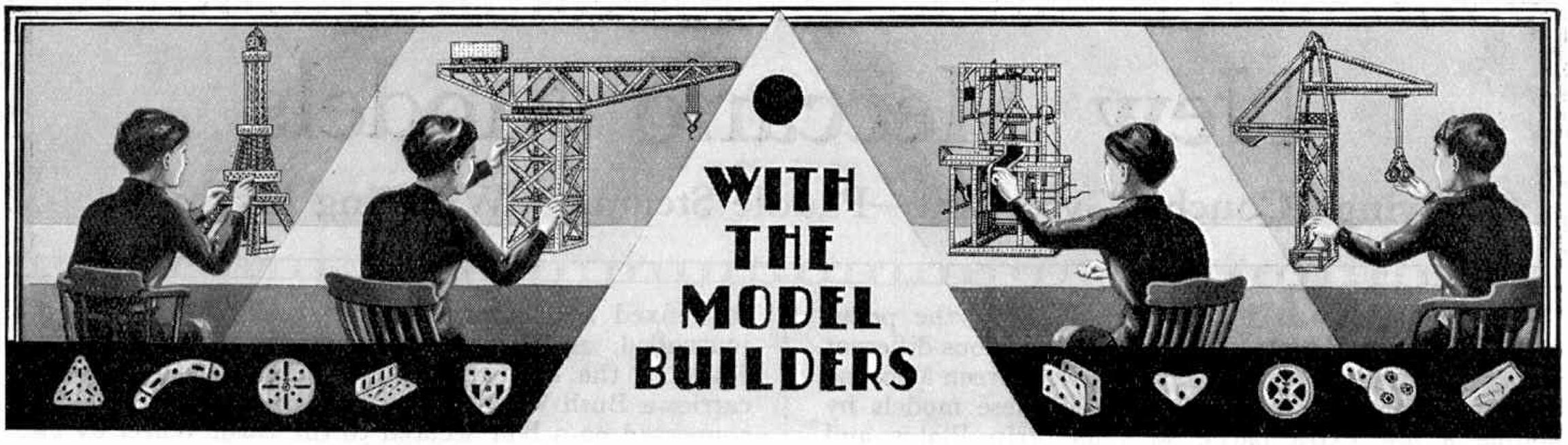
The operations of the machine are centrally controlled by means of an ingenious gear-box. So accurately has this mechanism been adjusted that the change-over from one operation to another is carried out smoothly and efficiently. Because of the complex nature of the gear changes it was necessary to cut special gears of different diameters and thicknesses. The most important part of the gear-box is a three-speed layshaft, which is controlled at the end of each operation by the travelling carriage itself.

The other models built by Mr. Lord, although not of textile machinery, deserve mention because of their general interest.

The windmill pump illustrated incorporates several devices designed to the builder's own ideas. The revolving headstock that carries the sails can be rotated to bring the sails into the wind by means of a tail vane. If the wind becomes too strong for safety, however, a second vane placed at the side turns the sails across the wind, in which position the headstock is automatically locked in position. The headstock can then be released only by hand. The drive to the pump is taken down the interior of the tower through a reduction gear of 2 : 1, and at the bottom connection is made with a system of variable stroke cranks that work the piston of the pump.

The electric truck, which is also shown in the upper illustration on this page, is fitted with automatic reverse and also automatic gear change to suit varying loads. When in bottom gear the model moves so slowly that its progress is hardly noticeable.

Readers may be interested to know that most of Mr. Lord's models have been sold to a travelling showman and are being exhibited in New South Wales as a side-show.



INTERNAL COMBUSTION ENGINES

Internal combustion engines form excellent subjects for modelling in Meccano. Although the principle of operation is the same for all types of four-stroke engines, there are many different types and variations of design, so that there is a fairly wide choice of subjects for modelling. A four-stroke engine makes a more interesting model subject than one operating on the two-stroke principle, but the latter is simpler and requires fewer parts to make. A four-stroke engine may be fitted with side valves or overhead valves, which may be operated either through push rods and rockers from the timing case, or by means of a camshaft mounted above the cylinder.

A single-cylinder engine of the motorcycle type is the easiest to build and requires fewer parts, yet it is almost as interesting as a much larger model having more cylinders. There are also different forms of twin-cylinder and four-cylinder engines of the motorcycle type. In car engines the cylinders are generally mounted in line and the usual number is four, six or eight cylinders for each engine. A few of the larger cars have the cylinders mounted in two banks in V formation, and a model of one of these would be exceedingly interesting but somewhat complicated.

In choosing the type of engine to reproduce in model form the range of parts that are available must of course be taken into consideration, and it is advisable to choose the type with which the constructor is most familiar. Illustrations and details of internal combustion engines are to be found in many good encyclopædias, and there are numerous excellent books from which the necessary information can be obtained.

GENERAL CONSTRUCTION

In order to expose the working of the engine it is advisable to build only a skeleton framework for the cylinder and crankcase. Thus the piston, timing gear and valves can be inspected while the engine is operating. It may be driven by a Clockwork or Electric Motor.

For a small engine, Hub Discs are useful for the crankcase, and for a larger engine the Ring Frames (No. 167B) are excellent. For very small engines the crankcase can be made from the Flanged Ball Races (No. 168A) or 4" Circular Plates. It is advisable to make the engine as large as the range of parts will permit, as more detail can be incorporated in a large engine. Each cylinder should be left open sided, and four vertical Strips or Angle Girders are sufficient to form guides for the piston. If a motorcycle type engine is being built the effect can be improved by adding circles of Curved Strips to represent the cooling fins. Ships' Funnels (No. 138) are useful for representing the inlet ports but the exhaust ports are generally larger. On a smaller engine Sleeve Pieces or Couplings can be used for the ports.

A RIGID CRANKSHAFT

The construction of a crankshaft for a multi-cylinder engine presents difficulty owing to the tendency of the built-up shaft to become out of line. The difficulty can be minimised in some cases by introducing additional bearings supporting the crankshaft between each crank, but this system complicates the design of the crankshaft and is not generally found in actual cars, except the more expensive ones and the sports models.

To build a rigid crankshaft, short Angle Girders can be used for the webs, two Girders being secured together to form a girder of square section. A Rod Socket is inserted in one end of the girder so formed so that the shank passes through the end hole in one of the Angle Girders and is secured by a nut. Bolts are inserted through the opposite sides of the box girder and screwed into the tapped bores of the Rod Socket. A Crank is bolted to the second Angle Girder so that the hole through its boss is in line with the hole in the Rod Socket, and an Axle Rod is passed through both and gripped securely. The other end of the box girder is similarly arranged and carries another Axle Rod that protrudes from the opposite side of the girder. One of these Rods forms the crankshaft and the other the crankpin. Angle Girders of double the length may be used for the second web if the crankpins are arranged at 180°. A crankshaft built up in this manner is very rigid as the bolts inserted in the tapped bores of the Rod Sockets prevent the possibility of the Socket turning independently of the Angle Girders.

THE FLYWHEEL AND PISTONS

A flywheel suitable for a fairly large car-type engine can be made from two Circular Strips that are spaced apart by $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips bolted around their rims. If sufficient Double Angle Strips are available they should complete the rim of the wheel, but a smaller number of Strips, spaced equidistantly, make a good flywheel although it does not have quite the same solid appearance. The hub of the flywheel consists of Face Plates that are secured in position by Strips forming spokes. The clutch may be incorporated in a flywheel so formed.

In the case of a single-cylinder engine, the flywheel should be fitted with weights to counterbalance the weight of the connecting rod and piston. Curved Strips of suitable radius can be used for this purpose.

A small piston can be made from Boiler Ends, two or three Boiler Ends being secured together by a Screwed Rod passed through the centre holes. A Double Bracket may be attached to the lower end of the Screwed Rod, so that it supports the gudgeon pin in the lower Boiler End, or the gudgeon pin can be pushed through the side holes of the Boiler End.

THE SPARKING PLUG

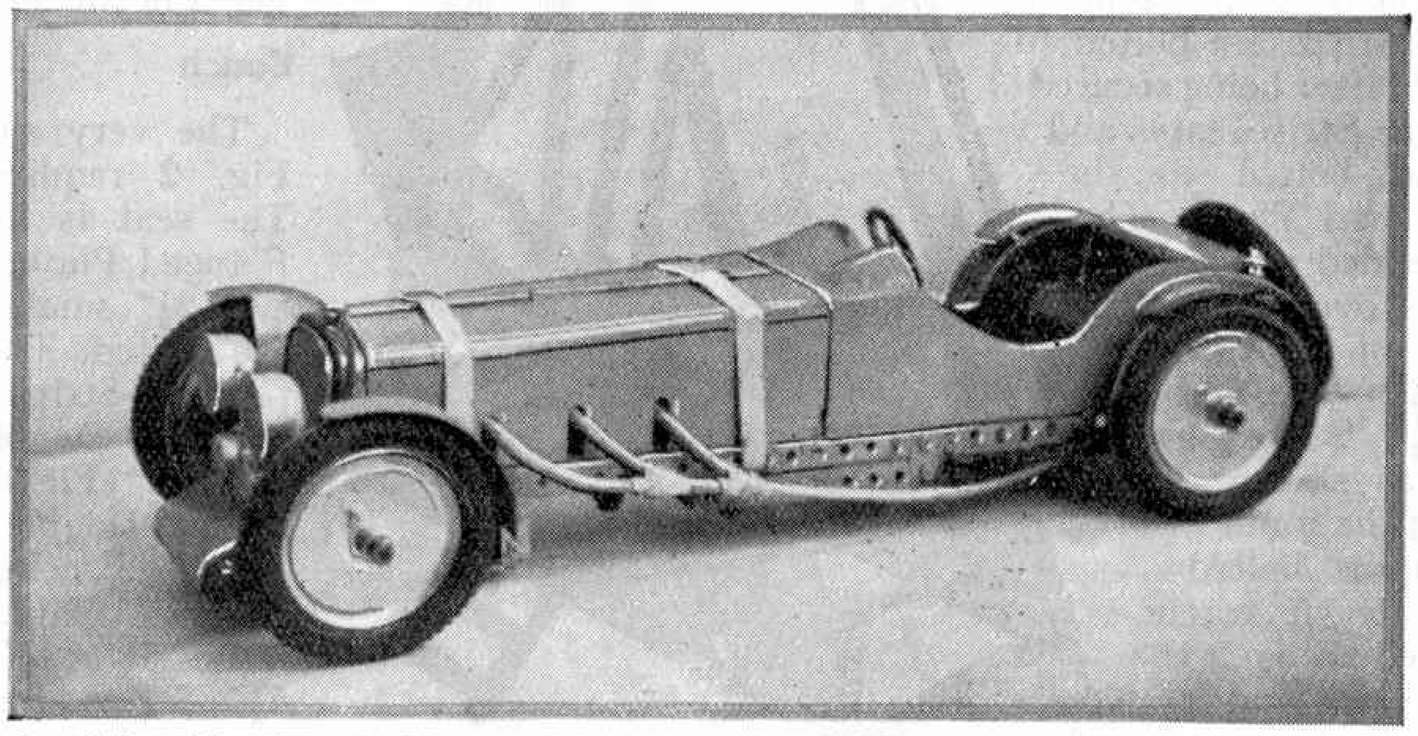
To add to the interest of the model it is a good plan to incorporate a small bulb to light up at the instant the spark occurs in the cylinder. A dummy sparking plug should be made, and the bulb mounted beneath this and connected up to suitable switch-gear so that it momentarily lights every other time the piston reaches the top of the cylinder in a four-stroke engine, or each time the piston comes to the top in a two-stroke engine. A suitable distributor will be necessary on a multi-cylinder engine so that the different "plugs" each spark at the correct moment. To add to the interest of the model a lever can be incorporated for advancing or retarding the "ignition," that is, for varying the instant at which the spark occurs in relation to the position of the piston in the cylinder.

The sparking plug can be represented by Chimney Adaptors superimposed by a $\frac{3}{4}"$ Flanged Wheel, a Screwed Rod being used to hold the parts together. The cooling fins beneath the terminals of some sparking plugs can be represented in the model by the $\frac{3}{4}"$ Discs from the X-Series Outfits. A Washer should be placed between each disc for spacing purposes. The pea lamps from the Meccano Lighting Set can be used at the "points" of the plug or a larger screw-in type bulb can be fitted if preferred.

NON-MECCANO PARTS

The illustration on this page shows a model racing car built up on a Meccano chassis and fitted with a body made of non-Meccano parts. Sheet metal and wood can be used effectively for such a model and in skilful hands can be made to produce excellent results. The builder of the racing car shown, has used his materials to advantage, and the finished car has a most realistic appearance. A model built on these lines is by no means easy to make and those boys who have tried cutting and bending sheet metal to any required shape will know that it is not so easy as it at first appears.

Motor cars are particularly good subjects for this branch of model-building, and for such models the entire chassis can be built of Meccano parts. Much detail work can be lavished on the chassis, which may embody all the essential features of its prototype and be driven by one of the Meccano Motors. The fitting of the body provides scope for original ideas for construction, and for ingenuity in overcoming the various difficulties of shaping. If well executed, the results will repay careful work, but it is probable that the first few attempts will be disappointing. Those who have not had previous experience with this kind of work will find that better results are obtainable by using Meccano parts for the body.



A realistic model racing car built by H. Jansen of North London. Meccano parts have been used for the chassis, which embodies a 3-speed gear-box and springing on all four wheels, and is driven by a 6-volt Electric Motor. Photograph by courtesy of "The Autocar."

CURVED ANGLE GIRDERS.—The range of Curved Strips at present included in the Meccano system enables various curved structures to be built up without difficulty. By securing Angle Brackets to Curved Strips it is possible to fix Strips round their edges, thus forming angle girders. Channel Segments (No. 119) can be used in certain cases in place of Curved Strips.

It is doubtful if sufficient uses could be found for a full range of curved angle girders to justify the manufacture of the parts, but the possibilities of such girders have been under consideration for some time past. (*Reply to F. Robertson, Carron, Falkirk.*)

GROOVED ARTILLERY WHEELS.—The proposal that Artillery Wheels should be made with grooved rims to take Dunlop Tyres has already received our attention. If grooved, the wheels would not be so satisfactory for use as Artillery Wheels, and they are used to a considerable extent for carts and farm vehicles. The use of these Wheels with Dunlop Tyres would not be in accordance with modern motor car practice, as cars are now fitted with wire-spoked wheels or disc wheels. For these reasons we are unable to consider the suggestion. (*Reply to W. G. Perkin, Buxton.*)

AERODROME GROUND STAFF.—It is scarcely necessary to introduce a special set of ground staff for model aerodromes as the many different figures included in the Dinky Toy range are excellent for this purpose. The Passengers and Engineering Staff are particularly suitable, and other Dinky Toys can be used to advantage for adding to the realism of an aerodrome. A special article dealing with the arrangement of a model aerodrome, and illustrating Dinky Toys in use, appeared in the July, 1934, "*M.M.*"—(*Reply to David Norman, Colchester.*)

New Meccano Models

Swing—Couch—Gyroplane—Paddle Steamer—Wringing Machine

THE models illustrated this month show the possibilities of the new Meccano parts for various different subjects. Constructors who have the Red-Green Meccano will find that they are able to build these models by adding a few extra parts, such as Strip Plates and Flexible Plates, to their Outfits. The new Plates greatly enhance the models by giving them a more solid appearance. By bringing their Outfits up to date constructors will find that the range of models they can build is increased to a surprising degree.

Hand-Operated Swing

The sides of the base of the model consist of $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates with $12\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips bolted along their edges. The Plates are spaced apart at the centre by crossed $5\frac{1}{2}''$ Strips that are bolted together and secured in place by Angle Brackets. At each end of the side Plates, $5\frac{1}{2}''$ Strips are bolted to $12\frac{1}{2}''$ Angle Girders, the latter being secured to the lower holes of the Strip Plates and braced by $2\frac{1}{2}''$ Strips bolted to the Girders and to the Strip Plates. The Angle Girders are extended upward by further similar Girders overlapped 11 holes. The upper ends of the Girders are bolted to a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and $5\frac{1}{2}''$ Strips are crossed and secured as shown to brace the upper ends of the frames. A horizontal $2\frac{1}{2}''$ Strip is bolted inside the apex of each A frame. A 5" Axle Rod is passed through the centre holes of these Strips and is held in place by a 1" Pulley on one end and a Crank on the other. The Rod carries another Crank between the two Strips.

The swing is made up of two Sector Plates connected together by $2\frac{1}{2}''$ Strips at their lower ends, and a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate forming the bottom is secured in place by means of Obtuse Angle Brackets that are bolted to the Sector Plates. The sides are formed from Curved Strips, and $12\frac{1}{2}''$ Strips are attached to these, the upper ends of the $12\frac{1}{2}''$ Strips being carried on the 5" Axle Rod. The Crank is bolted to one of the Strips and the Rod is gripped in its boss, so that the swing cannot move independently of the Rod.

The landing platforms are bolted to the sides of the base by means of Angle Brackets, and each consists of a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate, strengthened by three $2\frac{1}{2}''$ Strips and one $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted at the edges. A pair of $3\frac{1}{2}''$ Strips is bolted to each Double Angle Strip and further Double Angle Strips are fitted between them to form steps.

A Crank Handle carries a Road Wheel and is extended by a $3\frac{1}{2}''$ Axle Rod fixed in a Coupling. The Rod and Handle are journalled, as shown, in the end holes in the upper edges of the side Plates. The outer end of the Rod carries a Bush Wheel to which a $12\frac{1}{2}''$ Strip is pivotally connected on a bolt secured to the Bush Wheel by two nuts. The Strip is extended by a $3\frac{1}{2}''$ Strip that is pivoted to the Crank on the end of the 5" Rod carrying the swing. Thus as the Crank Handle is rotated, the Crank is rocked up and down and causes the swing to move to and fro.

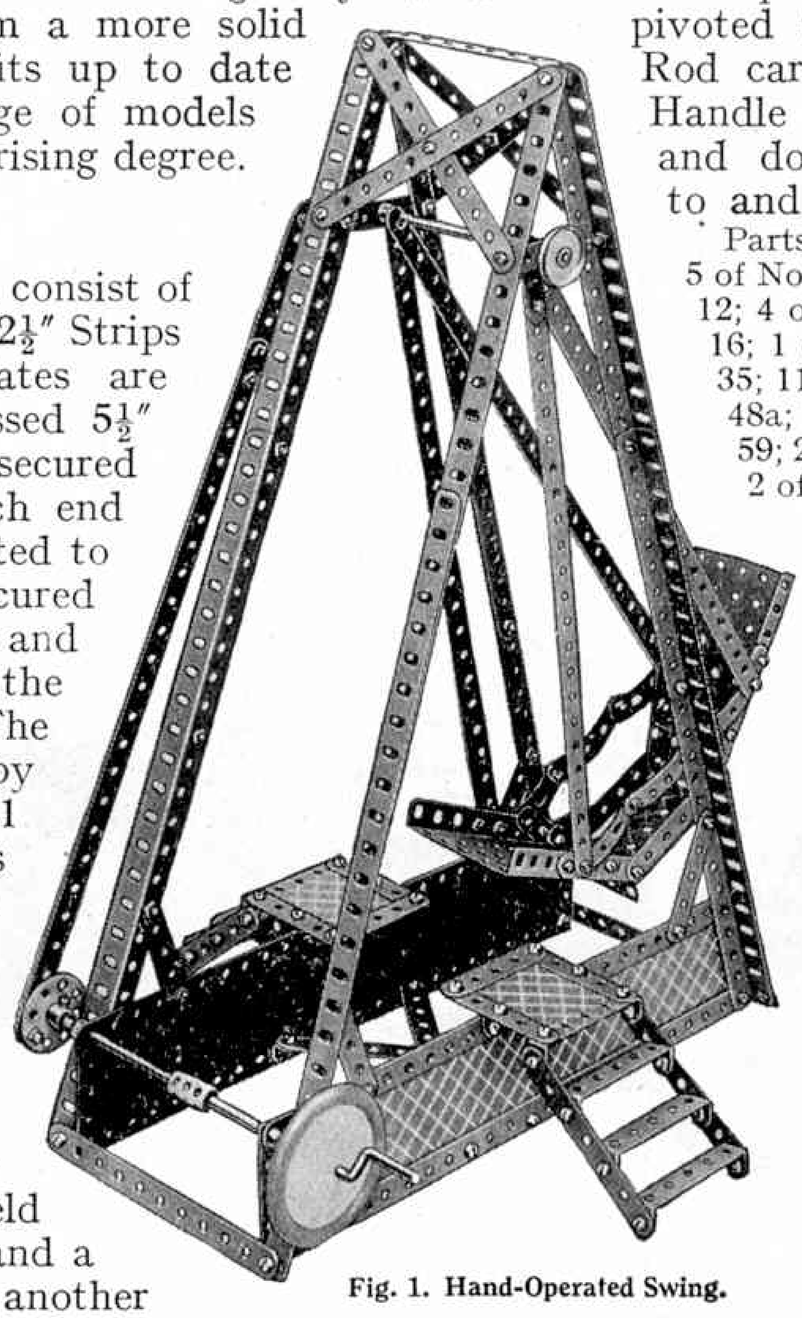


Fig. 1. Hand-Operated Swing.

Parts required for Swing: 9 of No. 1; 8 of No. 2; 5 of No. 3; 2 of No. 4; 12 of No. 5; 8 of No. 8; 8 of No. 12; 4 of No. 12a; 4 of No. 12c; 1 of No. 15; 1 of No. 16; 1 of No. 19s; 1 of No. 22; 1 of No. 24; 2 of No. 35; 117 of No. 37; 4 of No. 37a; 4 of No. 38; 8 of No. 48a; 1 of No. 48b; 1 of No. 51; 2 of No. 54a; 3 of No. 59; 2 of No. 62; 1 of No. 63; 2 of No. 90; 4 of No. 90a; 2 of No. 111c; 2 of No. 126; 1 of No. 187; 2 of No. 190; 2 of No. 197.

Couch

The very simple model shown in Fig. 2 requires little explanation. The seat is formed by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, at each end of which two $2\frac{1}{2}''$ small radius Curved Strips are bolted. The upper ends of each pair of Strips are connected by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are bolted to the Double Angle Strips and to Angle Brackets secured to the Flanged Plate. The back is formed by a $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate, two $5\frac{1}{2}''$ Strips being bolted along its upper edge.

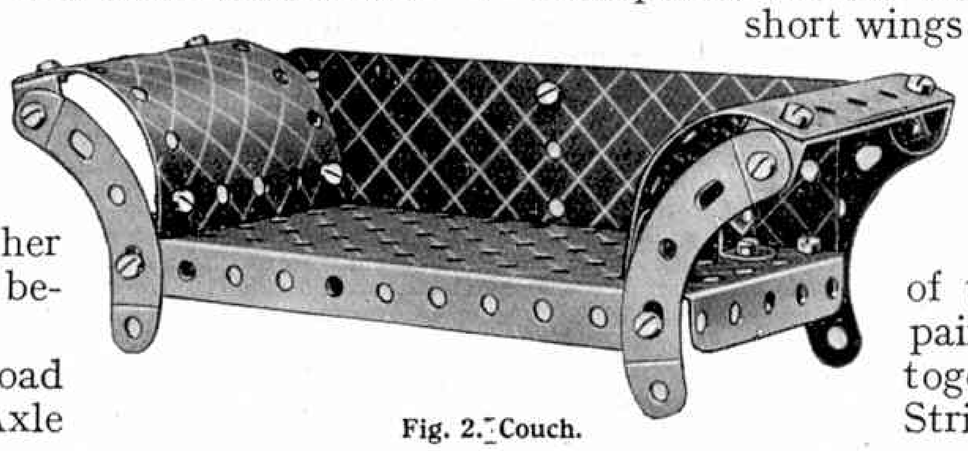


Fig. 2. Couch.

Parts required for Couch: 2 of No. 2; 4 of No. 12; 23 of No. 37; 2 of No. 48a; 1 of No. 52; 4 of No. 90a; 1 of No. 189; 2 of No. 190.

Cierva "Autogiro"

Gyroplanes form a class of aircraft quite distinct from the usual form of aeroplane. Instead of having wings, they depend for their lift upon revolving rotors consisting of long blades that somewhat resemble windmill sails. The Cierva "Autogiro" is the best known aeroplane of this type, and is noteworthy for the remarkably slow speed it can maintain with perfect stability. It has a low landing speed, and can alight on, or take-off from, a very small area. In the latest type of "Autogiro" there is no mainplane, but the fuselage is sometimes provided with short wings that serve as stabilisers and it has the usual fin and rudder and a fairly large tailplane.

The Meccano model illustrated in Fig. 3 is of this type of aircraft. The fuselage is made up of two pairs of $5\frac{1}{2}''$ Strips and two pairs of $2\frac{1}{2}''$ Strips that are joined together and bolted to vertical $2\frac{1}{2}''$ Strips projecting beneath the fuselage

to form the undercarriage. A $3\frac{1}{2}''$ Axle Rod is journalled in the lower holes of the Strips and carries 1″ Pulleys forming landing wheels. At the nose, the $2\frac{1}{2}''$ Strips are bolted to Flat Trunnions, and the sides are joined together by Double Brackets, one of which carries a $\frac{3}{8}''$ Bolt that is fixed by two nuts. The propeller, consisting of a $3\frac{1}{2}''$ Strip, is free to turn on this Bolt.

The tailplane is represented by two Trunnions and a $2\frac{1}{2}''$ Curved Strip forms the rudder and fin. A similar Curved Strip is fitted beneath the fuselage for a skid. The mainplane, which in the actual aircraft serves only as a stabiliser, is formed from two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates that are secured to $2\frac{1}{2}''$ Strips and Curved Strips. The vertical Rod carrying the rotor is journalled in a $2\frac{1}{2}''$ Strip secured between the Flexible Plates, and also in a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip that is fitted between the sides of the fuselage. The rotor blades consist of two $12\frac{1}{2}''$ Strips bolted to a Bush Wheel, and a $5\frac{1}{2}''$ Strip is attached to each end of each $12\frac{1}{2}''$ Strip by means of a Flat Bracket.

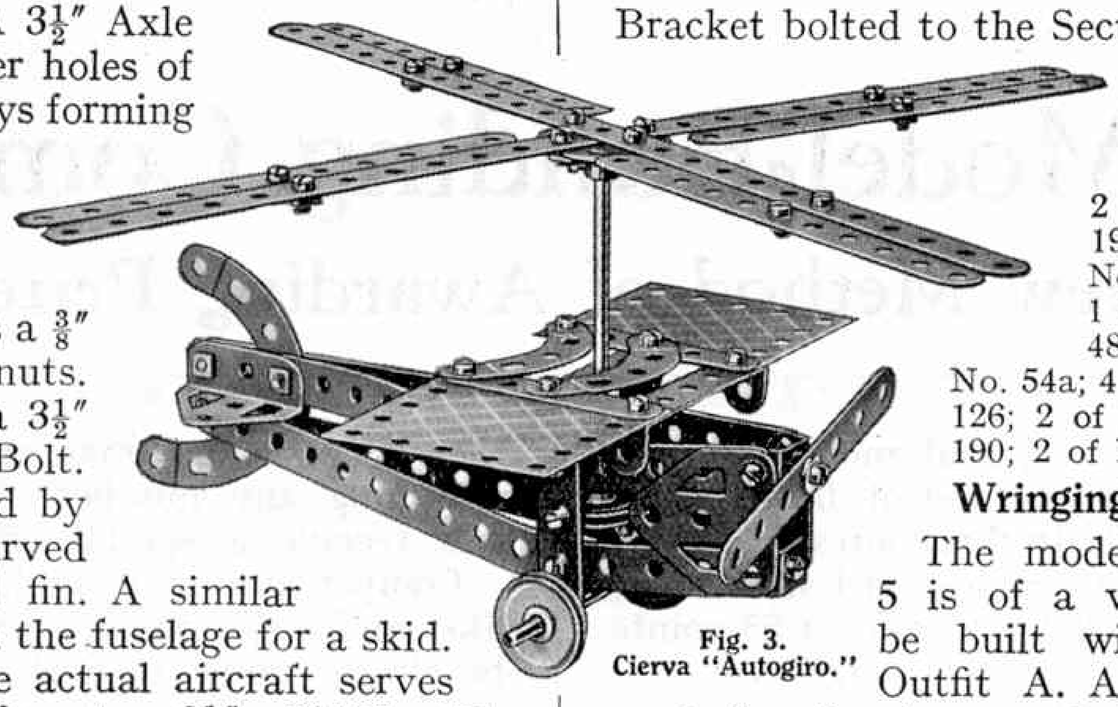


Fig. 3. Cierva "Autogiro."

Parts required for "Autogiro": 2 of No. 1; 8 of No. 2; 1 of No. 3; 9 of No. 5; 5 of No. 10; 2 of No. 11; 2 of No. 12; 2 of No. 16; 4 of No. 22; 1 of No. 24; 33 of No. 37; 3 of No. 37a; 7 of No. 38; 1 of No. 48; 1 of No. 48a; 4 of No. 90a; 2 of No. 111c; 2 of No. 126; 2 of No. 126a; 2 of No. 190.

Paddle Steamer

The deck of the steamer is formed from a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a Sector Plate, the two being secured together by $12\frac{1}{2}''$ Strips bolted to their side Flanges. The Strips are extended by $5\frac{1}{2}''$ Strips, each overlapped two holes, that are bolted to vertical $2\frac{1}{2}''$ Strips forming the stem of the hull. The sides are filled in with Flexible Plates and additional $5\frac{1}{2}''$ and $12\frac{1}{2}''$ Strips are bolted along their lower edges. The Strips are spaced apart by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, and a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fitted between them at the stern.

The paddle wheels are represented by 3″ Pulleys, and $2\frac{1}{2}''$ Curved Strips form shields for these. The Curved Strips are bolted to the sides of the deck in the form of semicircles, and $5\frac{1}{2}''$ Strips are fixed, as shown, by means of Flat Brackets and Trunnions. The Trunnions support a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip forming the bridge, a $2\frac{1}{2}''$ Strip being fixed to it by means of an Angle Bracket.

The funnel is made from four $2\frac{1}{2}''$ Strips secured together by Flat Brackets and Double Brackets and attached to the deck by Angle Brackets. The two masts are represented by $3\frac{1}{2}''$ Axle Rods passed through holes in the Flanged Plate. The Rods carry 1″ Pulley Wheels that rest on the Plate, and at their upper ends they are fitted with Spring Clips, the forward Rod carrying also a $\frac{1}{2}''$ loose Pulley that is retained in place by an Anchoring Spring (No. 176). A length of cord is tied to a Flat Bracket in the bows, and after passing round the upper ends of both masts is tied to an Angle Bracket bolted to the Sector Plate at the stern.

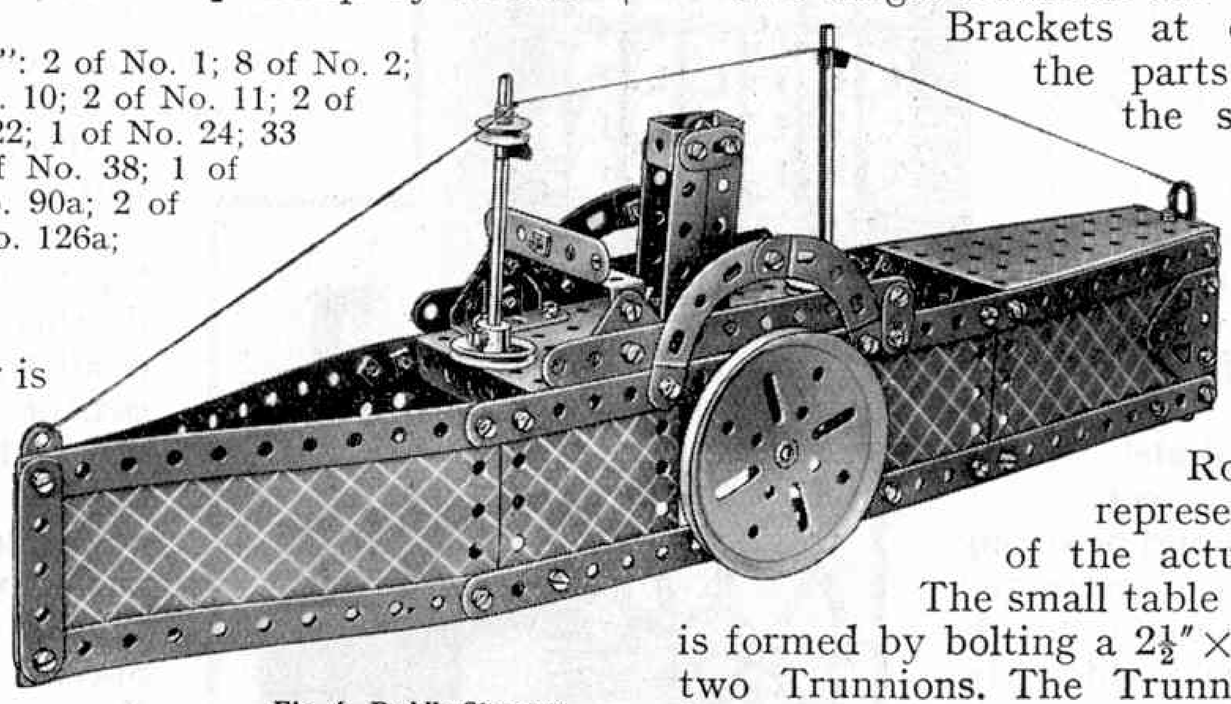


Fig. 4. Paddle Steamer.

Parts required for Paddle Steamer: 4 of No. 1; 6 of No. 2; 9 of No. 5; 5 of No. 10; 2 of No. 11; 4 of No. 12; 1 of No. 15b; 2 of No. 16; 1 of No. 17; 2 of No. 19b; 3 of No. 22; 1 of No. 23; 6 of No. 35; 58 of No. 37; 2 of No. 37a; 1 of No. 40; 1 of No. 48; 3 of No. 48a; 1 of No. 51; 1 of No. 52; 1 of No. 54a; 4 of No. 90a; 2 of No. 111c; 2 of No. 126; 2 of No. 126a; 1 of No. 176; 4 of No. 190; 2 of No. 191; 2 of No. 192.

Wringing Machine

The model wringing machine in Fig. 5 is of a very simple nature and can be built with the parts contained in Outfit A. A $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is used for the base and four Angle Brackets, bolted to this, support $2\frac{1}{2}''$ Strips. Flat Trunnions are bolted to the upper ends of the pairs of Strips and carry further $2\frac{1}{2}''$ Strips between which two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted. The Double Angle Strips are spaced from the side Strips by means of nuts on each securing bolt, $\frac{3}{8}''$ Bolts being used for this purpose.

Two Angle Brackets are bolted to additional Angle Brackets at each side of the model, the parts being so arranged that the slots can carry two Axle Rods as shown. One of the rods is the shaft of the Crank Handle, and the other is a 2″ Axle Rod. These represent the rollers, and the Crank Handle carries a Road Wheel that serves to represent the heavy handwheel of the actual machine.

The small table at the front of the machine is formed by bolting a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate between two Trunnions. The Trunnions are attached to the front pair of legs.

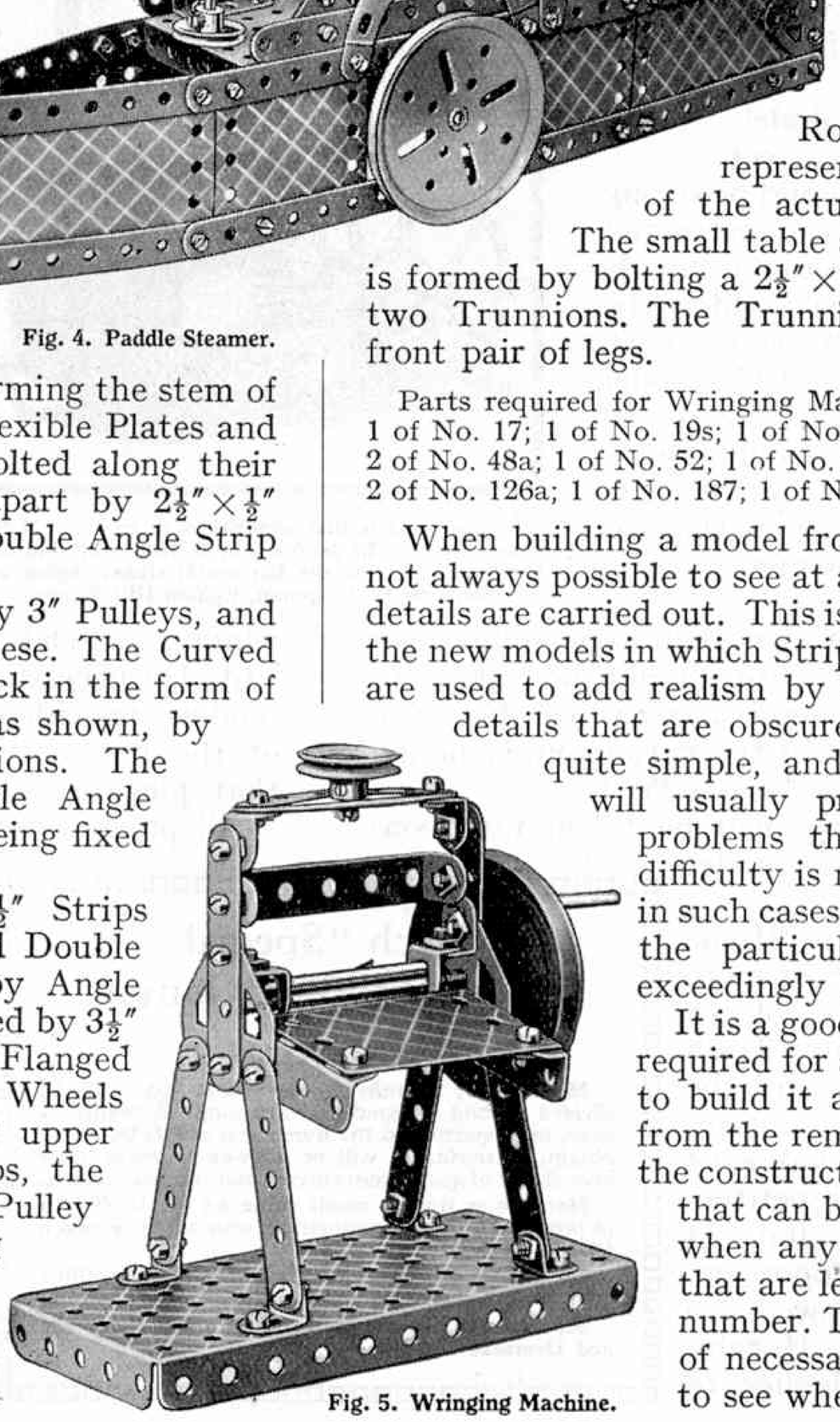


Fig. 5. Wringing Machine.

Parts required for Wringing Machine: 6 of No. 5; 8 of No. 12; 1 of No. 17; 1 of No. 19s; 1 of No. 22; 24 of No. 37; 4 of No. 37a; 2 of No. 48a; 1 of No. 52; 1 of No. 90a; 4 of No. 111c; 2 of No. 126; 2 of No. 126a; 1 of No. 187; 1 of No. 188.

When building a model from a single illustration it is not always possible to see at a glance exactly how all the details are carried out. This is particularly apparent with the new models in which Strip Plates and Flexible Plates are used to add realism by filling in open spaces. The details that are obscured from view are generally quite simple, and a few moments' thought will usually provide a solution to any problems that arise. Occasionally the difficulty is not overcome so easily, and in such cases the list of parts required for the particular model will be found exceedingly helpful.

It is a good plan to select all the parts required for a model before commencing to build it and to keep them separate from the remainder of the Outfit. Start the construction by assembling the parts that can be seen fairly clearly, so that when any difficulties occur the parts that are left are comparatively few in number. Thus, with the limited range of necessary parts, it should be easy to see where each should be used.

Special Model-Building Competition

New Method of Awarding Prizes

THIS month we announce a special model-building competition in which a new method of deciding the prizewinners will be introduced. In this contest points to a total of 100 will be allotted to each model submitted, and every competitor whose model obtains over 55 points will receive either a prize or a special certificate.

Instead of announcing First, Second and Third Prizes and a number of smaller prizes, as we have done hitherto, we offer in this contest Meccano or Hornby goods to a total value of £24, and the method by which the recipients will be chosen is described below.

The highest prize it is possible for any one competitor to win in this contest consists of goods value £8.

In deciding the competitors to receive prizes the competition judges will allot points to each model according to its merits when considered under the following heads:

Sound Construction. Models should be built on correct mechanical principles, and should be strong, cleanly designed and neatly constructed. The Meccano parts used should not be mutilated or altered in any way unless this is absolutely necessary. Meccano parts only should be used throughout the model. Maximum points under this head—50.

Originality. Competitors should be as original as possible, both in regard to their choice of subject, and to their methods of using Meccano parts. Maximum points under this head—25.

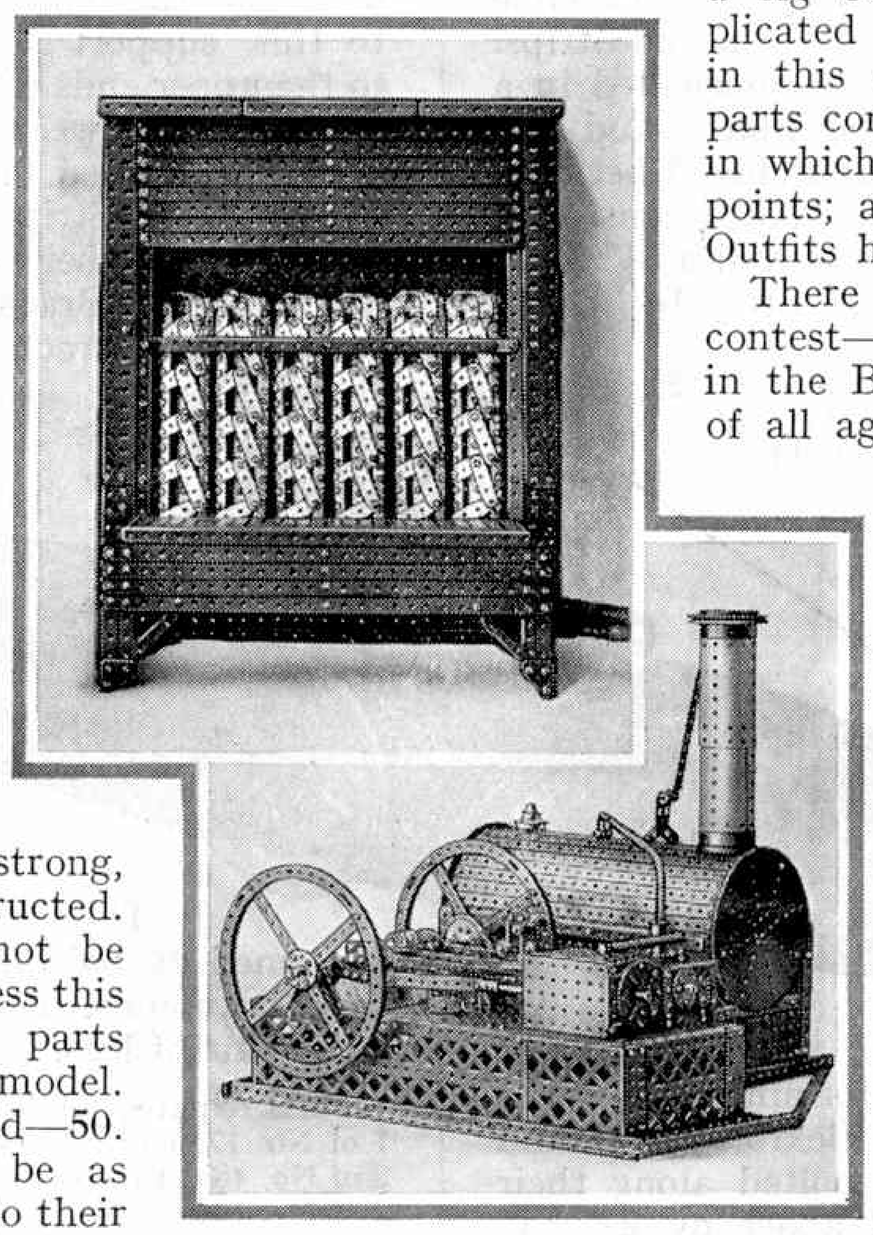
Realism. In models that are definitely miniatures of prototypes the greatest care should be taken to reproduce not only the general appearance, but also as far as possible the details of the various movements. Maximum points under this head—25.

The age of the competitor will be taken into consideration in awarding marks under each of the above headings.

Competitors in each Section, Home and Overseas, who obtain 75 or more points will receive a share of £8 worth of Meccano or Hornby Train goods in exact proportion to the number of points they obtain. Meccano or Hornby goods value £4 will be divided among competitors who obtain between 65 and 74 points, also in strict proportion. Prizewinners will be allowed to choose any Meccano or Hornby goods in the current catalogues to the value of the prize awarded to them. Competitors obtaining any number of points between 55 and 64 will receive a special certificate.

Competitors may build any kind of models they like, and any number of parts may be used. It should be clearly understood that it is not necessary to have a big Outfit or to build a large and complicated model in order to ensure success in this contest. It is not the number of parts contained in a model, but the manner in which the parts are used that will gain points; and therefore owners of all sizes of Outfits have an equal chance.

There will be two Sections only in this contest—A for competitors of all ages living in the British Isles; and B for competitors of all ages living Overseas.



Two fine models that won prizes in recent "M.M." competitions. The gas fire is by D. Holloway, Squirrels Heath, Essex, and the horizontal steam engine and boiler by H. Chapman, Egham Hill, Surrey.

Actual models must not be sent in for this competition. A clear photograph or a good drawing, together with a brief description, if this is considered necessary, is all that is required. Each competitor must write his name, full address and age on the back of each photograph, drawing or sheet of paper submitted, and envelopes containing entries should be addressed to "March Special Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13.

Entries for Section A must be received not later than 30th April, 1935, and those for Section B not later than 29th June, 1935. It should be noted that photographs or drawings of prize-winning models become the property of Meccano Ltd. Unsuccessful models will be returned to the senders provided that a stamped addressed envelope of the necessary size is enclosed with the entry for that purpose.

All prizewinners will be notified by post as soon after the closing dates as possible, and the full lists of awards, together with illustrations and descriptions of prize-winning models, will be published in due course in the "*M.M.*" Prize-winners will have the opportunity of choosing any items they like from current Meccano and Hornby Train price lists. Models that already appear in any of the Meccano publications are not eligible for entry in this contest. Competitors should make sure that full details are stated on the backs of the photographs or drawings submitted.

March "Special" Model-Building Contest

The Prizes

Meccano or Hornby goods value £8 will be divided among competitors obtaining 75 points or over, in proportion to the number of points that they obtain. Prizewinners will be allowed to make their own choice of goods from current Meccano catalogues.

Meccano or Hornby goods value £4 will be divided in proportion among competitors who obtain between 65 and 74 points.

Certificates of Merit will be awarded to competitors who obtain between 55 and 64 points.

Separate sets of prizes will be awarded in the Home and Overseas Sections.

Model-Building Competition Results

By Frank Hornby

List of Awards in the "Autumn" Contest (Home)

In deciding the prizewinners in this Contest, points were allocated to each model submitted according to its merits when considered under the following heads: *Construction* (Maximum points possible 40); *Originality* (maximum 25); *Realism* (maximum 25); *General Interest* (maximum 10). *Total points possible:* 100. The competitors who obtained the highest points are as follows:

Section A (Home competitors over 14)

1st, Meccano or Hornby Goods value £3-3s.: A. Williams, Cardiff (85 points). 2nd, Goods value £2-2s.: T. Tomlinson, Guildford (80). 3rd, Goods value £1-1s.: A. Crossland, Chesterfield (73).

Goods value 10/6: R. Walford, Newton Abbot (65 points); S. Thompson, London, S.W.18 (64); J. Thompson, London, N.14 (63); H. Stephenson, Liverpool (63); C. Parker, Hove (62); F. Byron, Liverpool 13 (62); C. Malherbe, St. Heliers, Jersey (60); R. Monk, Caterham (59).

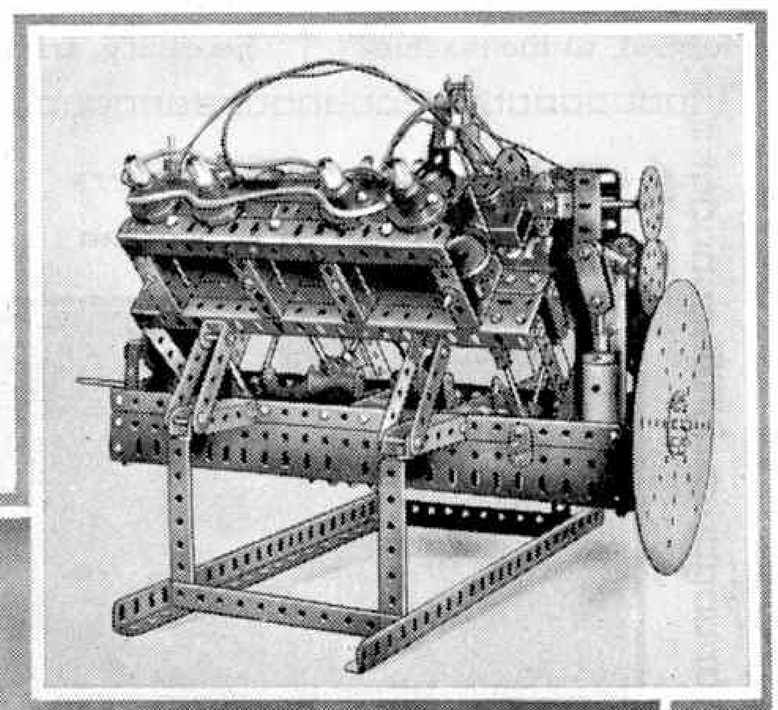
Goods value 5/–: A. Forster, Southall (58 points); G. Gillespie, London, W.6 (57); M. Lewitt, Shiremoor, Northumberland (57); F. Nunn, Colchester (56); W. Palmer, Clacton-on-Sea (55); L. Buckingham, Attleborough, Norfolk (54); A. Cole, Salisbury (53); J. Hopkins, London, N.W.2 (52).

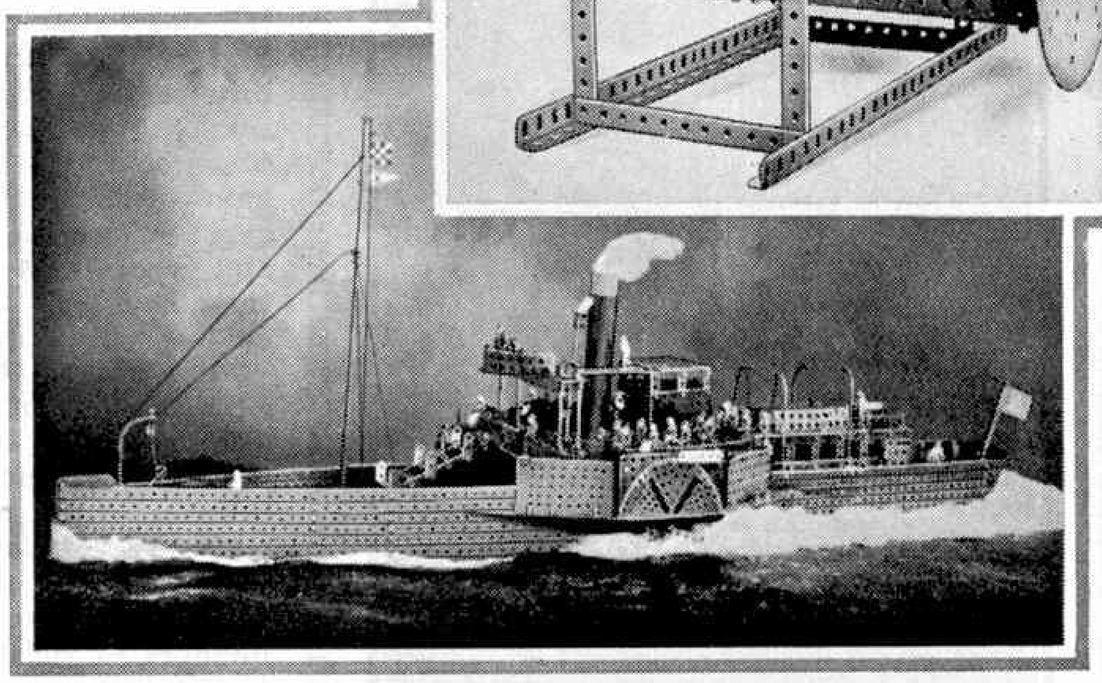
Section B (Home competitors under 14)

1st, Meccano or Hornby Goods value £2-2s.: K. Pim, Exeter (72 points). 2nd, Goods value £1-1s.: C. Kemp, Guildford (61). 3rd, Goods value 10/6: E. Brett-Harris, Weston-Super-Mare (60).

Goods value 5/–: W. Soutar, Aberdeen (58 points); J. Hall, Louth, Lincs. (57); C. Batten, London, N.22 (55); P. Fairfield, Bowdon, Cheshire (53); K. Blundell, Shiremoor, Northumberland (53); G. Claridge, Copford, Essex (52); J. Dowell, Blackburn (50); C. Holden, Ballymena (48).

Goods value 2/6: R. Brown, Hereford; V. Featherstone, Widnes, Lancs.; J. Gibson, Accrington; C. Haines, Hampton-on-Thames; J. Neale, Oxford; R. Smallshaw, Accrington; D. Smith, Barnstaple; A. Walkden, Darwen, Lancs.





Prizewinning models from the "Autumn" Contest. (Right) Internal combustion engine, by A. Williams, Cardiff. (Below) A well-built paddle steamer by K. Pim, Exeter.

Contrary to my usual custom, I am heading my brief description of the principal prizewinning models with a few words about the First Prize model in Section B. Although the model secured only 72 points against the 85 points earned by the First Prize model in Section A, I think the former is a very praiseworthy effort and if it had been a little more original it would have gained many more points. The model is a reproduction of a paddle steamer and is illustrated on this page. It is very well constructed and a lot of trouble has been taken to give it a thoroughly realistic appearance, for both of which features the model was allotted a high percentage of points.

The hull of the model is made entirely from Strips, bolted to further Strips bent to form ribs. The superstructure and paddle wheel casings are made from Flat Plates, which are bolted on to a framework of Angle Girders. The construction of the bridge is carried out with Flat Girders, and Rods, held in position by Collars, are used for the supporting pillars and stanchions. Realism is obtained by placing small figures of people in suitable positions and also by the inclusion of considerable detail in the lifeboats and davits. Unfortunately the funnel is not made from standard Meccano parts, but is cut from tinplate. It is painted in suitable colours and provided with cotton wool for smoke.

In regard to originality and general interest the First Prize model in Section A would be hard to excel. It is a working representation of a V-eight internal combustion engine, and is designed to show the working parts of the engine only. The illustration on this page can give only a slight idea of the careful work that has been done in the working out of the details of the mechanism, which in parts is very complicated. The camshafts are twin and although they are not of the overhead type they are in the trough of the cylinder block. They consist of two $11\frac{1}{2}''$ Rods journalled at each end in $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to upright $5\frac{1}{2}''$ Angle Girders. The cams consist of Collars with bolts screwed into their threaded holes so that the heads of the bolts strike the valve rods at every revolution of the camshaft. Special drive arrangements are provided to rotate the two camshafts in opposite directions.

Another interesting part of the model is the commutator for regulating the firing sequence of the spark plugs, which in the model are represented by eight 4-volt electric lamps. The commutator is driven from the main shaft through a straight drive consisting of two 57-teeth gears. The lamps are lighted in the following sequence: 1, 5, 3, 7, 4, 8, 2, 6. The commutator is a Face Plate to which eight insulated bolts are attached with their heads facing the same direction. From these bolts insulated wires are led to the various lamps. A contact maker consisting of a Buffer mounted on a Bush Wheel rotates on a shaft and makes contact with each of the bolts in turn. The shaft on which the Bush Wheel is mounted is journalled in the centre hole of the Face Plate, and also in a cross Strip bolted to the framework of the model. A Compression Spring is inserted to ensure good contact between the Buffer and the bolt heads. The entire model is driven by a 6-volt Electric Motor.

Alan H. Williams, the builder of this model, is to be congratulated not only on his success in the competition but also on the original ideas incorporated in the constructional details of the model.

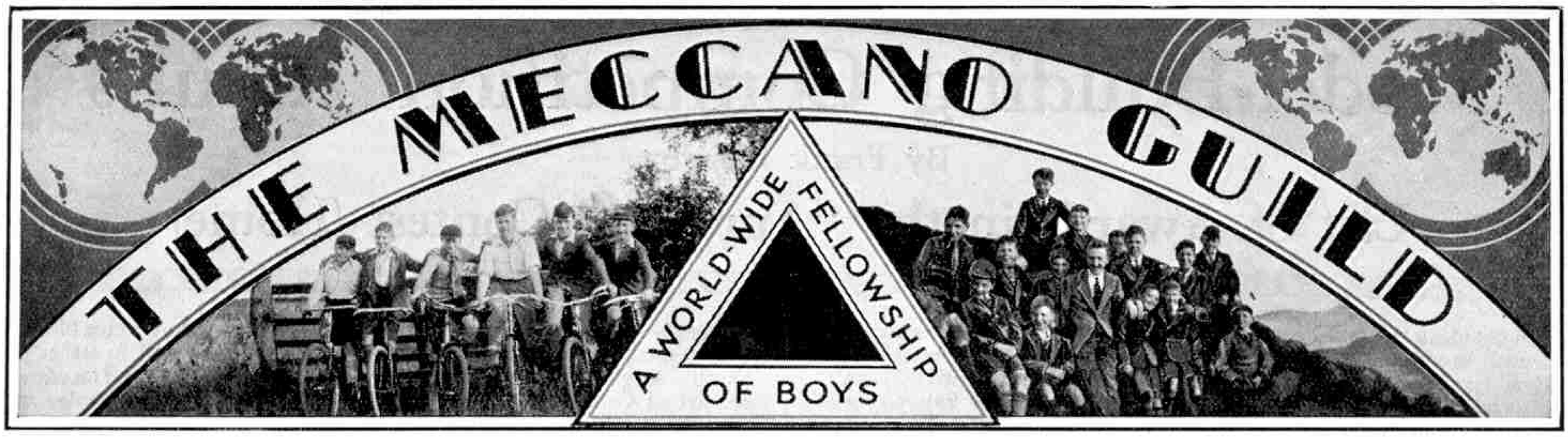
Another interesting model is that submitted by T. Tomlinson, which represents a church bell complete with mounting and headstock as seen in most churches. The bell itself is made up of $5\frac{1}{2}''$ Strips bolted to $2\frac{1}{2}''$ Curved Strips, which in turn are bolted to a Face Plate. The headstock on which the bell is hung is made up of $2\frac{1}{2}''$ Curved Strips and $2\frac{1}{2}''$ Strips, with a $9\frac{1}{2}''$ Flat Girder on top and a $5\frac{1}{2}''$ Flat Girder at the bottom, and is extended downward on either side of the bell by $1\frac{1}{2}''$ Flat Girders. The straps or keys, which hold the bell to the headstock, are $3\frac{1}{2}''$ Screwed Rods.

The rims of the wheel round which the bell rope passes consist of Curved Strips, with $12\frac{1}{2}''$ Strips bent and bolted between them to form a pulley, and the spokes are made with $5\frac{1}{2}''$ and $3''$ Angle Girders. The bell clapper is a $5''$ Rod, at one end of which is a Fork Piece and at the other end a $\frac{3}{4}''$ Pinion and a Contrate Wheel. The clapper is attached to the Face Plate of the bell by the Fork Piece.

A. A. Crossland's model is a neat reproduction of Sydney Harbour Bridge.

A streamlined motor car based on the Chrysler "*Royal 8*," and an interesting "space ship," were submitted by C. Kemp and E. Brett-Harris respectively. The latter represents the builder's idea of a vehicle for journeying in space, and consists of a bullet-shaped body propelled by rockets. Inside the body are control and wireless rooms, sleeping accommodation, observation room, and provisions apartments. The model is original in conception, but the constructional work might be improved, and this fact spoilt its chance of winning a bigger prize.

The remaining prizewinning models are all well built, but I regret to say that there are no really original ideas among them. Originality in a competition model is always a strong point in its favour, and I strongly advise competitors who won only small prizes in this Contest to try and find really novel subjects for future competition models.



Visiting the Home of the Ford Car

Visits and excursions are particularly enjoyable to members of Meccano clubs, and those in the home counties, and possibly others farther afield, will be glad to know that they will be welcome at the great factory of the Ford Motor Co. Ltd., at Dagenham. There they will be able to follow the whole process of the manufacture of cars from the production of the steel, and the pouring of molten metal into the moulds in which castings are formed, to the machining and finishing of the components and their assembly into complete vehicles.

A tour of these wonderful works with a fully qualified guide to explain everything that can be seen will be a memorable experience to the members of all clubs that are in a position to make the necessary arrangements. Mondays, Tuesdays and Thursdays are set aside for the tours, which begin at 10.30 a.m. and 2.30 p.m., and take about 2½ hours. Leaders who wish to take advantage of this privilege should write for details to The Ford Motor Co. Ltd., Dagenham, Essex, marking their letters "Visits Department." Early application is advised, and the number expected to take part in the visit should be stated.

Interest will be added to the visit by a river cruise in the *"New Dagenham,"* a motor ship that takes passengers from Westminster Pier to Dagenham and returns after the tour of the works has been completed, for London's docks, shipping and famous bridges and buildings combine to make such a cruise a unique attraction. From May next, the *"New Dagenham"* will leave Westminster Pier at 11.30 a.m. on Tuesdays and Thursdays and will be due back at 5.30 p.m. The charge for the return journey is 3/6, and those who wish to adopt this ideal way of reaching Dagenham should ask for information when writing to make arrangements for their visit.

Meccano Club Photographs

Group photographs of club members and portraits of Leaders, secretaries and other officials are attractive features of the Guild pages of the *"M.M.,"* and their appearance is enthusiastically welcomed by the members of the clubs concerned. There are still many clubs that have not been adequately represented in this popular Meccano club gallery, and I hope that the Leaders of these organisations will take care that they are not left out permanently. The present is a particularly suitable time for obtaining club photographs, for in most clubs final preparations are being made for the Exhibitions that close the second winter session, and little difficulty therefore is experienced in bringing members together in order to obtain representative group photographs.

The publication of good photographs is valuable publicity and a splendid aid to recruiting, for nothing could be more attractive to a Meccano enthusiast than the prospect of joining a group of happy club members. This applies also to Branches of the Hornby Railway Company and the officials of all Branches that have not recently figured in the *"M.M."* in this manner should arrange to have suitable photographs taken as soon as possible.

Meccano Club Leaders

No. 79. Mr. L. Morgan

Mr. L. Morgan has been Leader of the Wednesbury M.C. since its affiliation in March of last year. Keen competition between the "Nuts" and the "Bolts," the two sections of the club, has raised the standard of model-building, and other pursuits include Fretwork and the construction of model aeroplanes.

Correspondence between Meccano Clubs

I have been interested to note a growing desire in certain quarters for correspondence between clubs, the purpose of course being the exchange of notes and news of club life, and generally to strengthen the bonds of friendship that common interests call into existence. If properly worked, such a scheme can be of the greatest value and I should be very pleased to make the necessary arrangements for clubs whose members are attracted by this extension of the correspondence club.

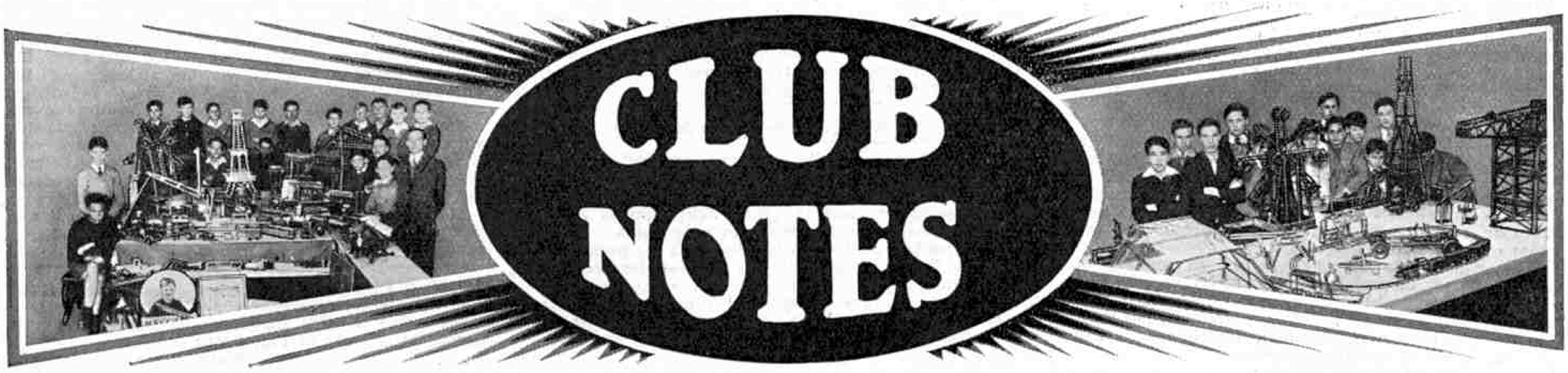
In order to secure the best results from correspondence of this kind, a senior member should be elected as correspondent, and if possible he should be released from other official club duties in order to give him ample opportunity for gathering news and noting events of interest. Only when this is done will he be able to convey to his correspondents in another club a comprehensive idea of the spirit that animates his own organisation in addition to details of the club programme. This plan has the additional advantage that the ordinary routine of club life is not disturbed, for Leaders have no further burdens cast upon them, except general supervision of letters, and secretaries can continue to devote their energies to their usual tasks, including the preparation of reports to Headquarters, the general medium for the exchange of ideas on club proceedings and the centre of club life generally.

Correspondence of the kind suggested between clubs is not a substitute for the exchange of letters between individual members of the Meccano Guild. The Correspondence Club is open to every member of the Guild, whether he belongs to a club or not, and is particularly valuable to the lone member in Canada, South Africa, Australia or elsewhere overseas. At present it is enjoying a boom, but there is plenty of room for new members and I hope that all Meccano Guild enthusiasts who have not already joined will think seriously of doing so. In most cases interesting correspondents can be found immediately for all newcomers, and I should be pleased to send the necessary application forms to all Guild members who are interested.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:

BELFAST—H. McKee, 22, Eastleigh Drive, Knock.
BLOXWICH—A. Cooper, 6, Maple Street.
BOSTON—W. J. R. Medlock, Vauxhall House.
CEYLON—A. Damheek, Kadawata.
HULL—G. E. Blackburn, 15, National Avenue.
LONDON, N.1.—V. Miller, 25, Bewdley Street.
NEWTOWNARDS—J. Getty, Hillcrest.
ROTHERHAM—S. Gummer, "Cranwell," Wickersley Road.
WARRINGTON—E. N. Fletcher, Brook House, Grappenhall Road.



Middlesbrough M.C.—A second Visit to the Middlesbrough Swimming Baths, where the filtration plant was thoroughly investigated, was a great success. Locomotive Speed Trials and Motor Hill Climbing Contests have been held and a novelty in the form of a Drawing Contest was introduced, the subject being Ackermann steering gear. After a keen Debate the 12-hour clock was voted superior to the 24-hour clock. Among the excellent models shown on Meccano Nights have been a Scotch Derrick Crane, equipped with floodlights, an Omnibus Destination Indicator and a Battle Cruiser. The Scout Troop is making excellent progress. Club roll: 44. *Secretary:* L. Shepherd, 29, High Street, North Ormesby, Middlesbrough.

Sutton Valence M.C.—Recent meetings have been devoted to Model-building Contests. In one of these models of farm machinery and implements were called for, the winning model being an excellent Tractor. A "Windmill" Contest was suggested by the existence of a famous old mill at Sutton Valence, and splendid models were submitted. The Christmas season was celebrated by an Open Competition for super models. These were displayed at the School on the last day of the term, the Exhibition being opened by Mr. C. R. Boswell, President. Club roll: 20. *Secretary:* C. G. Ledger, Little Belringham Farm, Sutton Valence, Kent.

Bexleyheath Boys' Central School M.C.—A high standard has been attained in recent club work of all kinds. Members are keen, and the club and the Guild are so popular that the Guild Badge is reported to be a common sight in the school. A Talk has been given by the secretary on "*Realistic Miniature Models*." The cinematograph film, "*How a Car Engine Works*," was exhibited and explained by Mr. Punch, Science Master. Club roll: 35. *Secretary:* F. A. Grout, 57, Nursery Avenue, Bexleyheath, Kent.

Wednesbury and District M.C.—Many interesting meetings have been held. Most of them have been devoted to Model-building, a large Fairground being constructed. A Lantern Lecture on "*British Railways*" has been given by the secretary, and excellent impromptu talks were given by members on "Hat Night." Visits have been made to the works of the "*Birmingham Gazette*," and those of the Midland Counties Dairy Limited, Wolverhampton, where the sterilising and pasteurising plants were inspected. An attractive programme is now being followed and the Leader will be glad to welcome new members. Club roll: 11. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

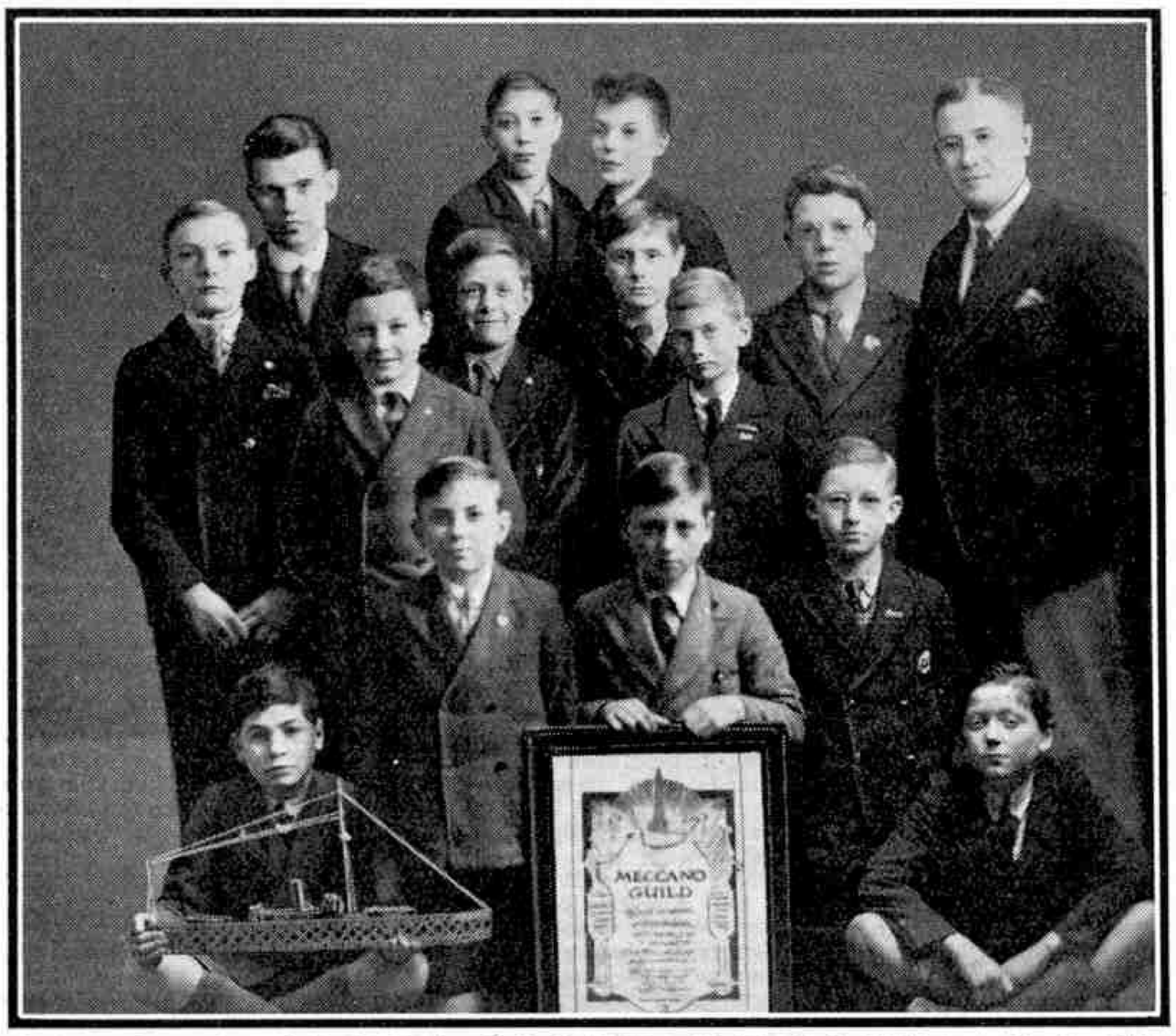
Whitgift School M.C.—The Science Museum and the works of Kodak Ltd. have been visited. The works of the Quasi-Arc Welding Company also have been inspected, and there members were interested in the Welding School, and in testing machines, one of which was capable of applying pressure of 100 tons to girders. Other recent meetings have been almost entirely devoted to Model-building. Club roll: 48. *Secretary:* J. A. Watson, 23, Addiscombe Avenue, Addiscombe, Croydon.

Kendal M.C.—Excellent model-building work has been carried on with club material, which is continually overhauled and replenished, in preparation for the club's Annual Exhibition. Table Tennis has been added to the games played, and fast and furious contests are held regularly. Members also are skilful at draughts and similar games. Club roll: 14. *Leader:* L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

Dagenham M.C.—The club's recent Exhibition was not as successful as had been hoped, owing to bad weather that affected the attendance. The models for this display were carefully planned and well constructed. Open Nights and Games Evenings continue, and preparations for a further Exhibition and a Party have already been made. Club roll: 46. *Secretary:* P. Bush, 121, Church Elm Lane, Dagenham, Essex.

South Parade Modern School (Cleckheaton) M.C.—Model-building Contests are held regularly, and keen competition prevails. The subjects of recent events of this kind have been lorries, cranes and representations of animals. A Visit was paid to Low Moor Engine Sheds, where members penetrated into the firebox of a locomotive in which a new arch was being installed. Club roll: 24. *Secretary:* K. Walker, 12, George Street, Cleckheaton, Yorks.

Corner House (Corsham) M.C.—Short Lectures by members have been prominent features of recent meetings, the subjects including "*The Epic of Mount Everest*," "*The Darjeeling-Himalayan Railway*," "*The Cheltenham Flyer*," "*Pompeii*" and "*Ice Caps*." At a Hobbies Meeting a cinematograph proved a great attraction, and several interesting films were shown. Model-building Evenings have been devoted to the construction of aircraft and of railway models, those shown at the latter included the "*Rocket*," various types of signals and a representation of a giant girder that formed an "out-of-gauge" load recently conveyed from Chepstow to Bath. Club roll: 21. *Secretary:* G. Dyke, Church Street, Corsham.



A group of members of the Harlesden Methodist M.C., with Mr. G. B. Weightman, Leader. This club was affiliated in January, 1932. Mr. Weightman himself is a keen model-builder, with original ideas, and members have made excellent progress under his enthusiastic guidance.

Old Charlton M.C.—In preparation for a Mock Trial, the novel plan of hiding clues to be discovered by detectives in charge of the case was adopted, and the proceedings at the trial itself in consequence were of surprising interest. Electrical Evenings have been held and visits paid to Gas and Tar Works at East Greenwich and to a Dairy and a Bakery. Talks by members and Debates have provided attractive evenings, and a Lecture on "*Interesting Principles in Building*" has been given by a supporter of the club. Models constructed in recent contests have included bridges and machines, and special interest was shown in a competition in which models of vehicles of the future were called for. Club roll: 22. *Secretary:* W. Jaques, 60, Gurdon Road, London, S.E.7.

CANADA

Rosemount (Regina) M.C.—Additions made to the attractions of the club include an extensive Library, to which Mr. J. T. Favelle, President and Leader, made a handsome contribution, and a Stamp Club, which holds special weekly meetings. Regular Model-building activities continue, and a Woodworking Section has been tried. Membership is increasing satisfactorily and includes several honorary members. Club funds also are increasing, and ambitious plans for visits to Toronto and Montreal are being discussed. Club roll: 16. *Secretary:* J. Watson, 974, Athol Street, Regina, Sask.

ITALY

Milan M.C.—Members built excellent working models, and planned a splendid Hornby Railway for the club's first Exhibition. Sections have been formed for photography, and for electrical and chemical experiments. The Library has been extended, and Table Tennis introduced. Lectures are excellent features of the programme, those given so far dealing with Italian railways and engineering projects, and one on "*The Italian Navy*," by Mr. C. Vigo, Corso Genova 19, Milan, Italy, President who was formerly a Naval Officer. Club roll: 14. *Secretary:* E. Vigo, Corso Genova 19, Milan, Italy.

SOUTH AFRICA

Malvern M.C.—A special feature is now being made of model-building by seniors to encourage and help juniors. In Sectional Model-building Contests, teams of four design and construct entries, special subjects being set in each competition. Papers on "*Lives of Great Men*" and similar subjects have been read by members, and in a Humorous Contest entrants were asked to describe dreams after eating plum pudding! An Open Night attracted 120 members and visitors. Members had made great preparations, the attractions including a display of hobbies, side shows of all kinds, among them a Meccano Bagatelle Table constructed by a member, guessing competitions and a musical programme. Refreshments also were provided and the receipts were nearly £9. Club roll: 80. *Secretary:* A. Hubbard, P.O. Box 8, Cleveland, Johannesburg, South Africa.

Pioneer (Pietermaritzburg) M.C.—Steady progress is being made, and great interest was displayed by visitors in a display of models exhibited at a meeting of the Maritzburg Amateur Horticultural Society. The 35 models on view included an Anti-aircraft Gun, and a Workshop and a House, both of which were fitted with electric light. The Deputy Mayor of Pietermaritzburg has promised a prize for the best model to be shown at the next similar Exhibition. Special Contests and Model-building Competitions in which a limited number of parts could be used have been held, and Debates on engineering and sporting topics have been arranged. Drill with the Boys' Brigade also continues. Club roll: 10. *Secretary:* A. H. Alley, 461, Burger Street, Pietermaritzburg, South Africa.

Clubs Not Yet Affiliated

Hoboken M.C.—This newly-formed Belgian club has already held a splendid Exhibition of models in the Public Library. This attracted more than 3,000 visitors, who were delighted with a magnificent display of models that included a representation, more than 9 ft. in length, of the Belgian liner "*Prince Baudouin*," a large Anti-Aircraft Gun, a Transporter Bridge, and an Electric Tramway. The success of the Exhibition was partly due to effective advertising by means of leaflets, advertisements in the newspapers and in picture houses, and a loud speaker installed at the entrance to the Exhibition Hall. *Leader:* Mr. J. Willems, Place du Kiosque, 87, Hoboken-lez-Anvers, Belgium.

Modern Aeroplane—(*Continued from page 149*)

Petrol is pumped by duplicated engine-driven pumps from the main tanks to the engine. It is interesting to note that special Meccano Bevel Wheels, Nos. 30A and 30C, and the Meccano Pointer, are incorporated in the fuel gauge.

After the installation of the power plant, the controls are installed. A normal control column, fitted with a hand grip that from its shape is known as a "spade" operates the elevators and ailerons by means of straight lengths of cable and chain passing over ball-bearing sprockets. Hanging rudder pedals, the tail trimmer and the wheel-raising mechanism are the other controls that are fitted.

The connections from the engine to the engine speed indicator, oil pressure gauge, and oil thermometer on the pilot's dashboard are now made, and the cowlings and fairings are then placed in position. The metal airscrew is mounted, together with the spinner, and the fuselage is completed. The wings are then attached to the fuselage by wing root forgings on each side, and give the "Courier" a span of 47 ft.

The upholstery of the cabin, which is 8 ft. long by 3 ft. 8 in. wide, remains to be completed in a scheme to suit the purchaser of the machine.

Just before the test flight the machine is weighed and the empty weight should be in the neighbourhood of 2,100 lb.; and on completion of this formality the pilot tests the aeroplane's performance. With the "Lynx" engine, it should have a top speed of 165 m.p.h., a cruising speed of 145 m.p.h., and a landing speed of 50 m.p.h.; and higher speeds are attained with more powerful engines.

It will be noticed in the illustration of the cockpit that wireless equipment is fitted between the front seats. When wireless is to be installed the whole machine requires to be "bonded"; that is every metal part on the machine has to be joined by wire and connected to the set to form an "earth." The bonding of the machine is done immediately before any covering is commenced.

A wind-driven electrical generator to provide power for the set is mounted in the front of the centre section on the starboard side, and a trailing aerial is so fitted that it can be let down through the floor of the cockpit when required, and drawn in again by turning a hand-wheel when the wireless is not being used, or when a landing is to be made. The set itself is slung in shock absorbers at the rear of the cabin beneath the luggage locker.

The "blind-flying" instruments are also well shown in the illustration of the cockpit. These consist of a turn and bank indicator and a fore-and-aft level. The compass can be seen immediately below these two instruments. Before delivery to the owner, the machine is taxied out to a special concrete circle on the aerodrome showing the points of the compass and there the instrument is carefully "swung"; that is the machine is turned towards each point of the compass and the compass needle is adjusted by means of small magnets. When the errors have been reduced to a minimum a table of deviations is prepared for use with the compass. This table is pinned up in the machine, and is an essential factor in accurate cross-country flying.

The new Airspeed "Courier" is then ready to leave the factory after passing through the hands of woodworkers, sheet metal workers, fabric workers, fitters, and dopers, each man a skilled worker and a specialist.

New Machine at Swindon—(*Cont. from page 161*)

depends on the mode of drive to be used. Machines of the past have, almost universally, relied upon a main shafting driven by a power plant, with the power transmitted by belts to countershafting and thence to machines; but the modern practice is to dispense with main shafting and operate the drive from a separate electric motor.

If it be the first case, then the fitter must be busy again, fitting the necessary pulleys to main shafting and countershafting; but if it be the other, then the electrician generally performs the final rites, although it does not always follow that a separate unit machine is without countershafts; and with such, the "strappy" or belt man would be called in to administer the *coup de grace*.

Thus, in the works at Swindon the march of progress goes on; and, it may be added, not without interest on the part of the men does a new machine commence its career. They are human enough to want to know "all about it," and, after all, when one fresh wonder succeeds another, each outstripping beyond comparison the performances of old machines, such interest is feasible.

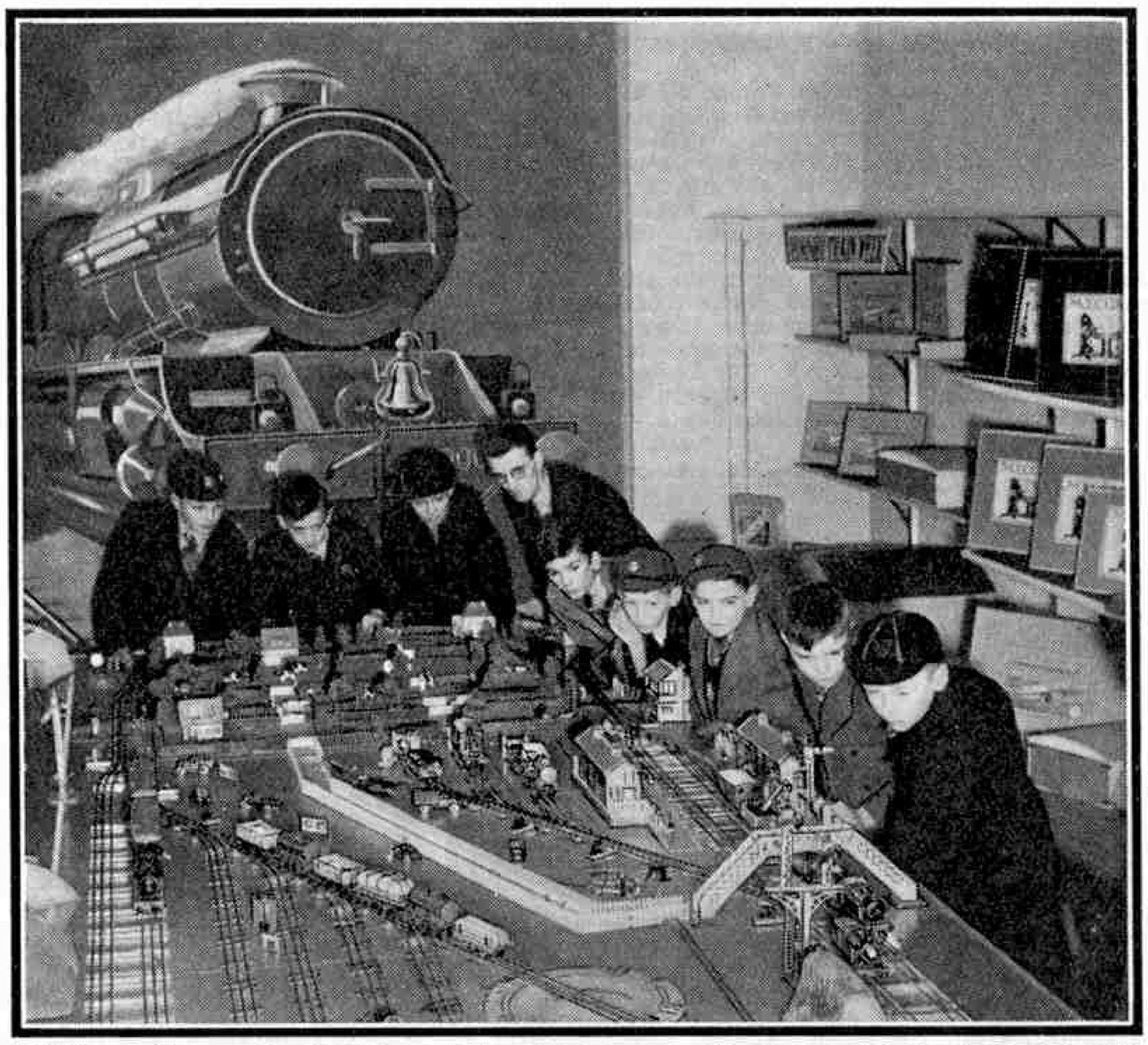
And yet, I believe that "Charles," that incorrigible veteran fitter with the famous rakish cap, gazes with a disapproving eye at them all, and pines in his heart for the unwieldy monstrosities he laid down reverently in his youth.

We are indebted to the courtesy of the Editor of the "*Great Western Railway Magazine*" for permission to reprint this interesting article.

Special Trains—(*Continued from page 155*)

train speed, and usually signalmen are under orders to give the specials precedence of all other traffic except express passenger trains, breakdown van trains going to clear the line, light engines going to assist disabled trains, or fire brigade trains.

Most readers are by now familiar with the wonderful wagons that British railways possess for dealing with exceptionally heavy or out-of-gauge loads. For loads of very exceptional dimensions special trains are required. With them travel expert staffs, who "nurse" the loads throughout their journeys; instructions to the staff concerning one of these trains may easily occupy as much as eight closely printed pages of type. Most of the movements of exceptional loads take place through the night or on a Sunday, when traffic is at a minimum. Such consignments as ships' rudders and electrical rotors are at times so wide that they block the parallel line for a whole journey. It has been known to be necessary to slew a section of main line railway into a new position, and to remove bodily such obstacles as signal posts, gate posts and even fog signalmen's huts, to allow one of these special trains to pass.



Miniature railway enthusiasts keenly interested in an electrically operated Hornby train layout arranged by Rushworths Ltd., of Huddersfield. The railway system includes a complete main line with sections of double track and two separate systems of sidings for shunting purposes.

A New Cycle White Patch

To enable every cyclist to meet the provisions of the new Road Traffic Acts, Bluemel Brothers Ltd. have introduced a new lightweight combined white patch and reflector of exceptionally neat design. The fitting consists of a piece of white celluloid of the well-known Bluemel "Featherweight" section, fitted with two strong mudguard clips and a white celluloid covered "Prismatic" reflector of new design. Full details of this useful unit, which costs only 1/6, can be had from Bluemel Brothers Ltd., Wolston, Coventry, on mentioning the "*M.M.*"

High Pressure Locomotive—(*Cont. from p. 175*)

Two vent pipes are fitted to these sloping sides, for in actual practice they are the tops of water tanks. The vents are built up in a similar manner to the handrails at the rear of the tender. The water-scoop top is represented in the model by a Boiler End, and the main tank vents by Buffer-shanks fitted with Collars.

For mounting the tender above the rails two horizontal Rods are fitted similar to those at the rear of the engine. The short vertical supports consist of 1½" Rods, the lower ends of which are carried in Bush Wheels secured to the baseboard.

The baseboard for this model should be at least 1" in thickness, and must measure about 6' 6" in length and 10" in width. The engine and tender are secured to this in the manner already described and in their correct positions, after which the track is screwed into position. Each rail consists of three 24½" Angle Girders overlapping each other two or more holes, the number depending upon the exact length of the baseboard. The sleepers, which consist of 7½" Strips, are then placed in position, one being used every 2½", and the whole track screwed down, preferably with black round headed screws. The model is now complete except for the piece of Sprocket Chain connecting the engine and tender, this being fitted last in order to get the exact length required.

If it is desired the characteristic letters L.N.E.R. and the number "10000" may be painted on the model, as shown in Fig. 1 of the first article of this series.

Moving Picture Projector—(*Cont. from p. 177*)

construction of this ingenious mechanism is quite simple, as a study of Fig. 4 will show.

Two Rods act as guides and keep the film pressed against the Pawls when they advance to pull the film downward. After leaving the gate the film passes over the take-up sprocket 16 (Fig. 1), which is driven by Sprocket Chain from the main drive. A small spring-controlled roller is provided to keep the film in engagement with the teeth of the sprocket.

The built-up crank handle 32 (Fig. 5) is intended for driving the projector by hand when "threading" the film.

The Electric Motor for driving the model is mounted in front of the projector below the lens housing, and the drive is transmitted by belts and Sprocket Chain. We understand that when fitted with an ordinary electric lamp the machine is capable of projecting a really bright and steady picture.

Meccano Exhibition in Wallasey

The Annual Conversazione of Wallasey Grammar School, held on 9th February, included a Hobbies Competition of which a Meccano Model-building Contest formed a popular section. The models shown were remarkable for their originality, and for the ingenuity displayed in overcoming difficulties. F. S. Miles won the First Prize with a model showing a section of the Mersey Tunnel, through which motor cars and lorries of the Dinky Toy series ran continuously. Above the tunnel itself was the Mersey, with ferry boats passing to and fro between the Liverpool and Wallasey landing stages. The Second Prize was won by F. Lawson, whose entry represented a pit shaft with winding gear, and an excellent model of an electric power station by L. Howson Jones was awarded honourable mention. Interest was added to the Conversazione by a display of working models, including a Workshop and a Ship Coaler, loaned by Meccano Ltd.

Turog Essay Competition

Spillers Ltd., millers of the famous Turog Flour, announce this month an interesting Prize Essay Competition open to boys and girls of all ages. Prizes to a total value of £320 are offered for essays not exceeding 150 words in length. General details of the competition will be found on *page xvi* of this issue, and further details are given in a special competition folder that may be obtained from any Turog baker or direct from Spillers Ltd., 40, St. Mary Axe, London, E.C.3. This folder contains also details of a generous free gift scheme.

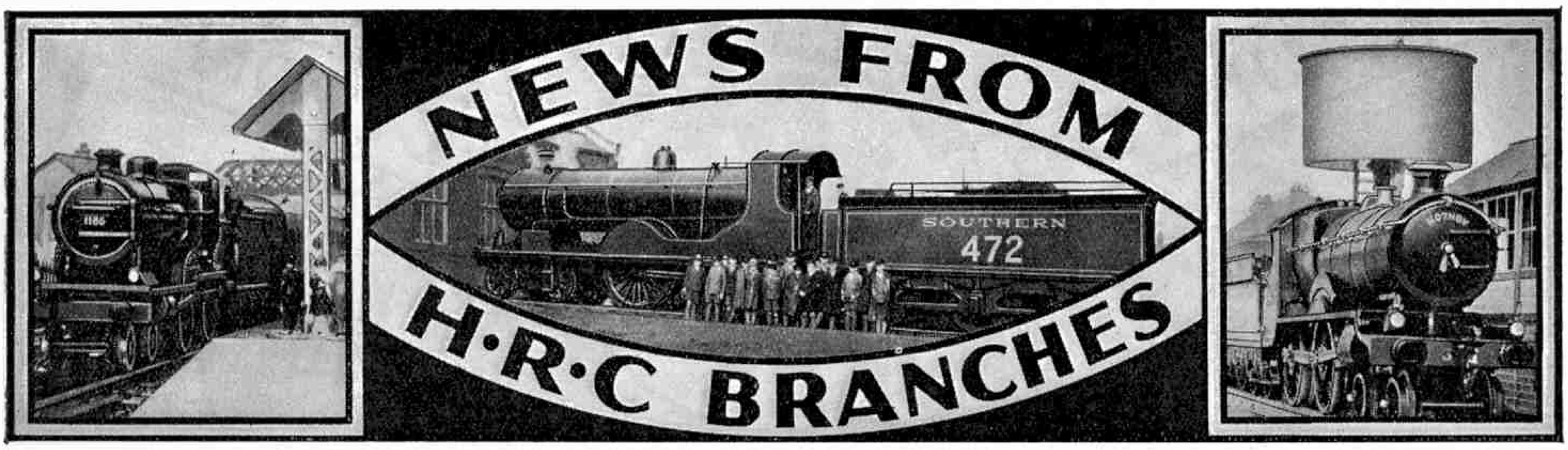
The Rivercraft Canoe Club

Those of our readers who are fond of water sports—particularly those residing within easy reach of the Thames—will find the Rivercraft Canoe Club of interest. Among its objects are the improvement of canoeing technique and the provision of centres where canoeists may meet for canoeing and camping. The Secretary of the Club, Mr. Owen Jones, will be glad to give full details to any reader of the "*M.M.*" who writes to him at Walton Bridge, Surrey.

"Meccano Magazine" Binders

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/- post free. Meccano Ltd., Binns Road, Liverpool 13.



Branch News

NEW BARNET.—Nearly 100 visitors attended the Branch Exhibition, and the excellent sum of more than £1 was added to Branch funds. A Social Evening also was held. The chief attraction was a Railway Film, and members and their friends contributed to the entertainment. Secretary: D. Edington, Normandhurst, Lyonsdown Road, New Barnet.

BROOKFIELD (WIGTON).—Meetings are being held twice weekly. The track is laid on trestle tables in the permanent Branch room and experimental timetables have been arranged in order to decide upon the track and the service to be run. A Hornby Control System is being installed, and special care is being taken to signal the track correctly and completely. Secretary: N. Lowe, Friends' School, Wigton, Cumberland.

CHORLTON-CUM-HARDY.—Great enthusiasm prevails among members of this newly-incorporated Branch. Track laying was quickly completed, and enjoyable running operations were carried out with the aid of seven locomotives. A new and larger track has now been completed, and attractive operations are continuously in progress at every meeting. A specially interesting visit was paid to the Manchester Model Railway Society's Exhibition. Secretary: G. H. Gill, 56, Highfield Road, Chorlton-cum-Hardy.

MAIDSTONE.—Members are busy reconstructing the Branch track, and other activities have included a Lantern Lecture on *"Railway Topics"* by Mr. C. J. Allen. This Lecture was given at a joint meeting with the Maidstone Crusaders, who afterwards visited the Branch room and workshop. Mr. Evernden gave a review of his experience with a 5 in. gauge locomotive. Visitors are welcomed at Branch meetings, and a box has been fixed in the club room to receive donations. Secretary: W. Hills, The Orchard, Lord Romney Hills, Maidstone.

PRIORY (HIGH WYCOMBE).—Excellent track meetings are being held, and realistic operations are carried out on the Branch layout, which has been carefully planned and constructed, and includes illuminated stations. A party from the Branch visited the Swindon works of the G.W.R. Secretary: J. T. Cosgrove, 54, Priory Road, High Wycombe, Bucks.

WOODFORD.—The track has been renovated, all the stations having been repainted and the bridges reconstructed. Further improvements are planned, and in the meantime track operations continue and Shunting Competitions and other contests are being held. Variety has been provided by a Draughts Competition. Secretary: J. H. Skelt, 27, Woodside Road, Woodford Wells, Essex.

ELMSIDE (EXETER).—The customary intense services of passenger and goods trains continue to be run at track meetings, the timetables being varied and the class of service altered from time to time. The running of the *"Cornish Riviera Express"* is still one of the greatest attractions, and this train has now run in miniature at 7.30 p.m. at each Branch meeting for 2½ years. Other services continue to increase in interest as the Branch layout is extended. Secretary: D. Legg, 25, Chute Street, Exeter.

ST. GILES' CATHEDRAL.—Splendid progress is being made, attendance records being created and great interest displayed. The Branch track is being kept in excellent repair and plans have been discussed for incorporating a semi-automatic electric signalling system. Competition Nights, Talks on *"Well-Known Schools"* and Cinematograph entertainments also have been arranged. The Christmas and New Year Party was a wonderful success. Secretary: H. W. Govan, 25, South Orchard Road, Edinburgh, 4.

FIRST SHEFFIELD.—Most of the meetings are devoted to track working, and special interest has been taken in running excursions, rival sections of the Branch co-operating in this work. The through service between "Liverpool" and "Euston" continues to run regularly. New scenery has been made for the "Liverpool" station, and other accessories introduced include hoardings for advertising purposes. Games Nights have been held, and special meetings have been devoted to constructional work and testing. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

Our photograph of members of the Belfort (Catford) Branch, No. 158, was taken during a visit to the S.R. Marshalling Yard at Hither Green, and Mr. Hardy, Yardmaster, is seen in the centre of the group. The Branch was incorporated in January, 1931, and has a long record of success.

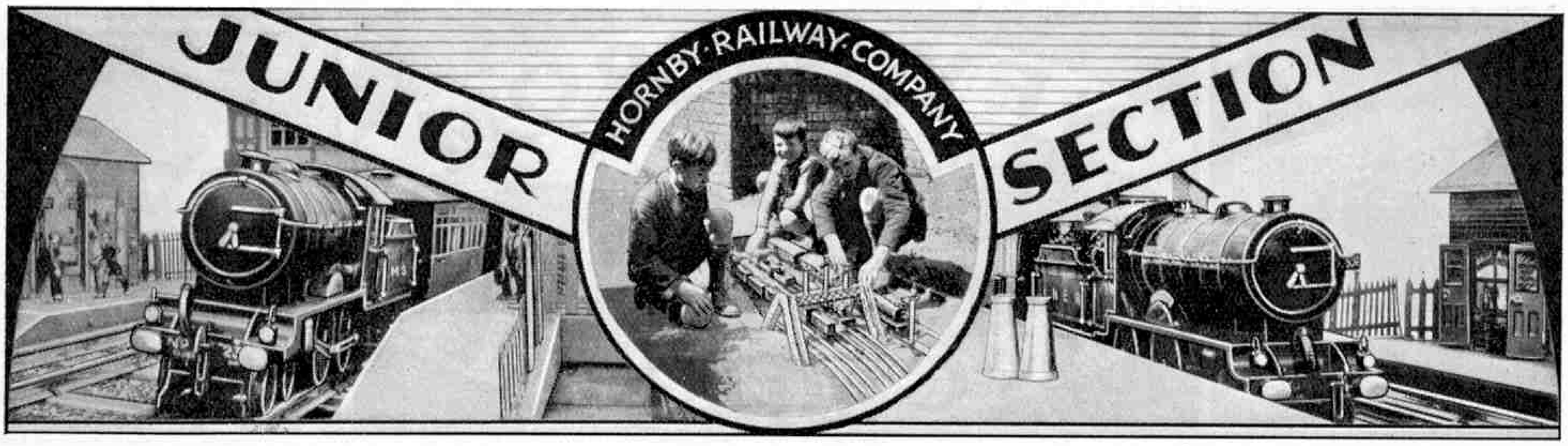
Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who apply.

BARNSLEY—K. Kenworthy, 6, California Garden Houses, Park Road.
CANONBURY—A. J. Lyne, 27, Alwyne Villas, London, N.1.
CARDIFF—J. P. Lowston, 44, Victoria Park Road, East.
CATERHAM VALLEY—T. S. Savill, Lamorna.
CLAPTON—Mr. H. Galpin, 23, Blurton Road, London, E.5.
ELTHAM—Mr. R. G. Frooms, 82, Greenvale Road, London, S.E.9.
GLASGOW—R. G. Langmuir, 11, Afton Street, Shawlands, S.I.
GLOUCESTER—V. F. Martin, 24, Brook St.
LIVERPOOL—Mr. T. C. Davies, 23, Ashfield, Wavertree.
MANCHESTER—L. A. F. Holland, 19, Park Road, Pendleton, Salford 6.
TAUNTON—N. Stalberg, Taunton School.
WELWYN—D. F. Hodsdon, "Denholme," Robbery Bottom.

Branches Recently Incorporated

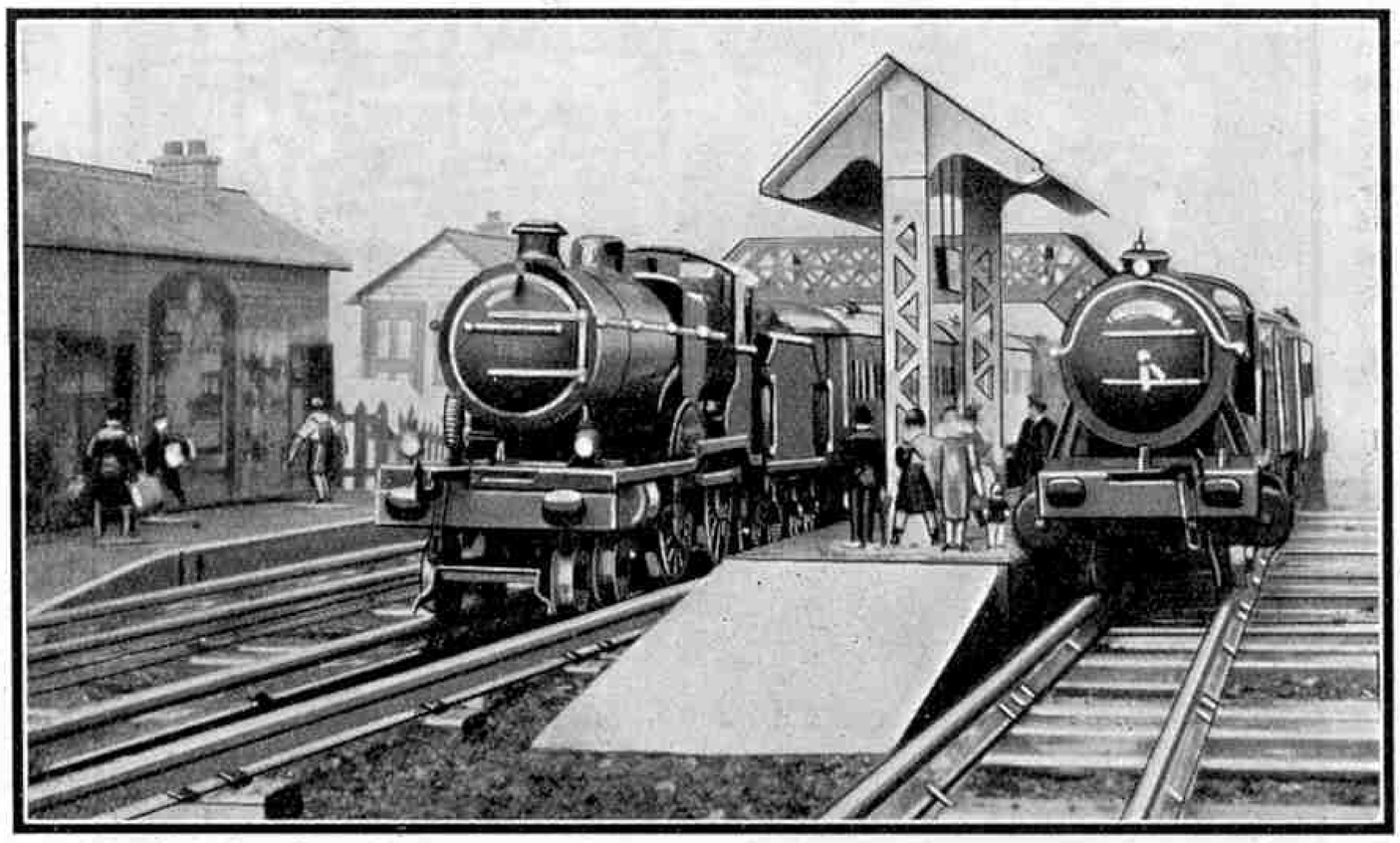
281. CHORLTON-CUM-HARDY—G. H. Gill, 56, Highfield Road, Chorlton-cum-Hardy, Manchester.
282. TARRAGINDI—C. McTaggart, Hamlet Terrace, Annerley, South Brisbane, Queensland, Australia.



STATION LAYOUTS IN MINIATURE

OF the various accessories that are used in connection with miniature railway systems none are so important, or so essential to the realism of the line, as stations. Trains must have somewhere to start from, and somewhere to arrive at the end of their journeys. Stations form the only possible base of operations, whether passenger or goods trains are involved, and without them train working could not be conducted with any degree of realism.

If we study actual stations with a view to selecting a suitable prototype for the station on our miniature railway system, we are immediately struck by the fact that there is a great variation in the details of their layout, although the main principle may be practically the same. This is only to be expected, as the conditions and circumstances in any one situation are not likely to be repeated exactly at the next point where a station is required. However, the chief features of almost any normal station can be reproduced with little difficulty by means of the components of the Hornby Series.



The Island Platform is used here as part of a junction station on a Hornby Railway. At one side of the platform is a main line express, while the branch line train is waiting on the other side.

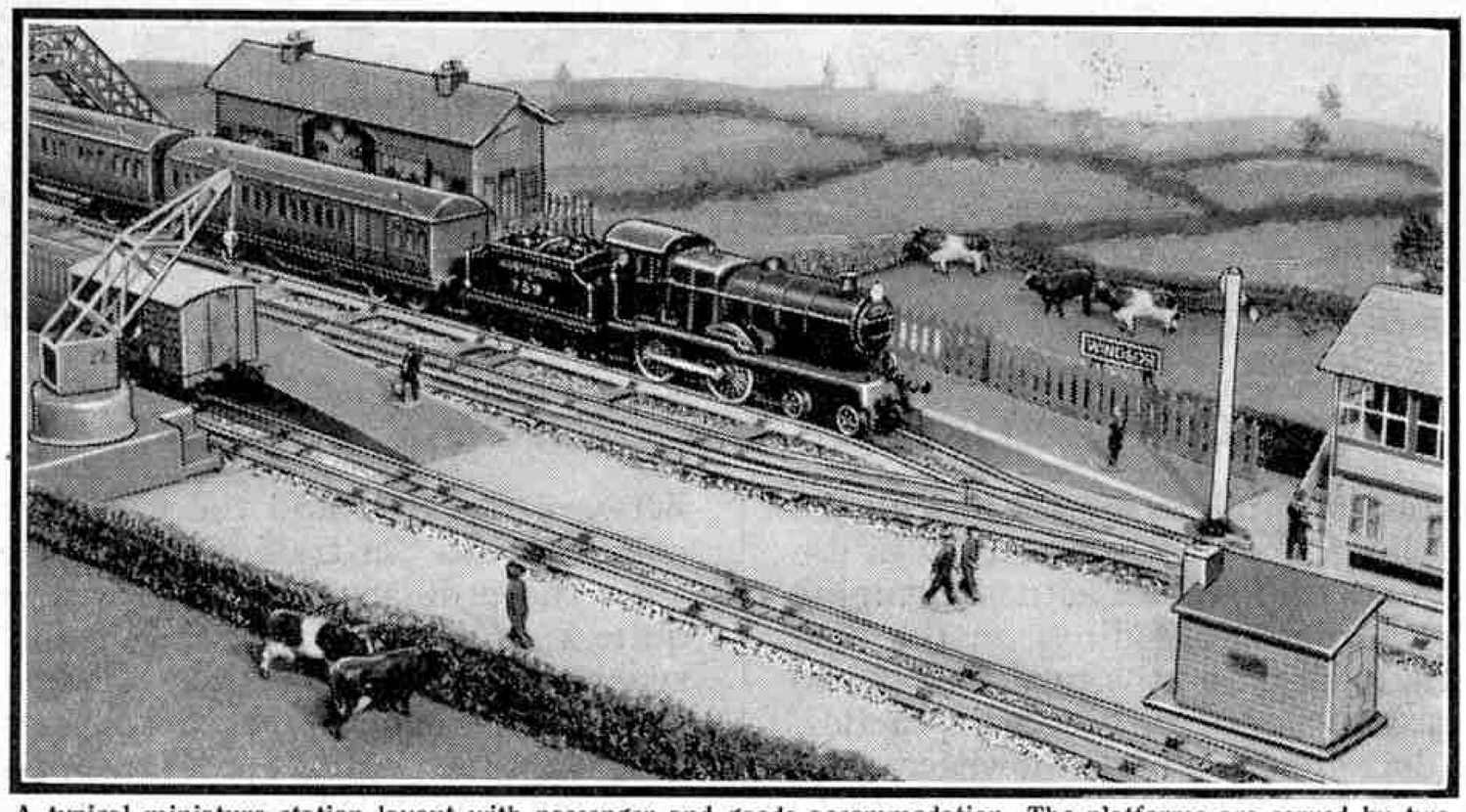
Where the ordinary passing station is being considered —as the most common type of station—a favourite arrangement is for each track to have its own separate platform, and on each platform the usual buildings and offices are situated. Access from one platform to another is afforded by a footbridge, or possibly a subway. As far as the road approach to either platform is concerned, this will depend on the exact situation at the place in question. Sometimes both platforms are directly connected to the road. At other times only one platform is directly accessible from the road, passengers then having to cross the line from the first platform to reach the other.

A passing station of this type, possessing two main or two identical platforms and buildings, is readily arranged by the use of Hornby material. The most important station in the Series is Railway Station No. 2, and its platform can be extended as required in either direction by the addition of lengths of the standard Passenger Platform. This is a great advantage, and enables the main station building to be situated centrally if required, or perhaps more towards one end of the whole platform length. This latter arrangement is invariably encountered when the road crosses under or over the railway at one end. In miniature the reproduction of such a situation is unusual, and has the advantage that it gives a long stretch of platform for the effective display of luggage, passengers and railwaymen, and miniature figures generally of the range of Hornby Railway Accessories and Meccano Dinky Toys.

Sometimes the plan is followed of having the main offices on one platform only, especially when access from the road is only possible from one side. This scheme can be followed in miniature quite satisfactorily, and is a pleasant change from what we may term the standard arrangement. The main side of the station may be formed by the use of a Hornby Railway Station No. 2, with its platforms extended as described previously. The other side of the station may be made up of sections of Passenger Platform joined together. If it is desired to provide some shelter on this platform for waiting passengers, one of the standard Island Platforms with its awning may be included, being converted from an "island" by the addition of Paled Fencing. This scheme has the advantage of requiring less width than the usual arrangement of two Railway Stations No. 2 facing each other, and is particularly useful where the space between the railway and the edge of the baseboard is restricted. If the main station and platform is placed on the side of the line opposite to the operator, the effect is very pleasing. The absence of buildings on the rear platform enables the trains to be dealt with easily, and provides plenty of scope for the use of the various accessories produced for stations.

Sometimes it is necessary in actual practice to arrange the station platform between the up and the down lines, the resulting arrangement being known as an island

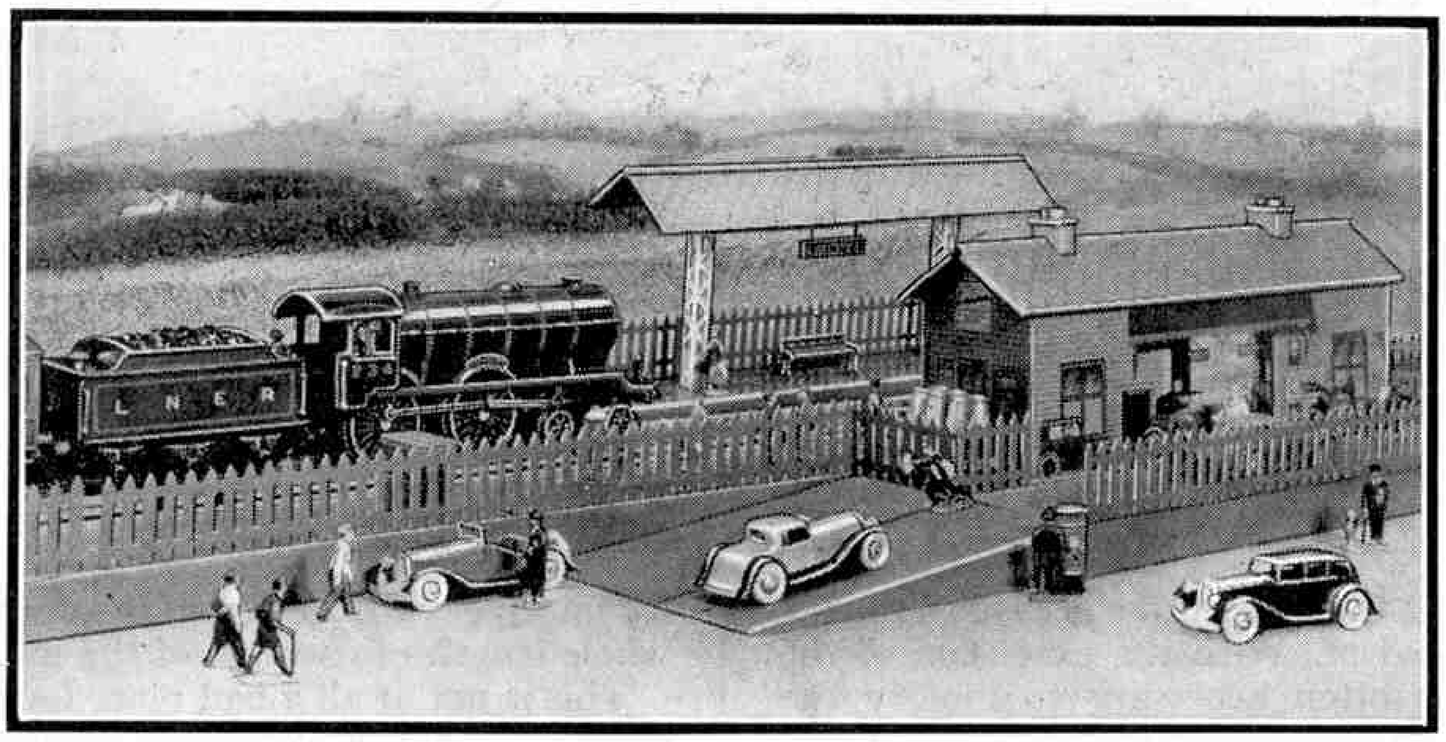
station or platform. Stations of this kind are particularly popular on the Great Central Section of the L.N.E.R., even a large important station such as Leicester being arranged on this principle. Island stations can be reproduced with good effect on a miniature railway by means of the standard Hornby Island Platform. Extensions to this by means of Passenger Platforms are possible, but the latter will require their Paled Fencing removed for this purpose. A station arranged in this way has the advantage that it can be laid down within quite small limits of space, if the lines can be made sufficiently wide apart to accommodate the platform. Such a station can even be provided where it would be impossible to arrange a double-platform station of the ordinary type.



A typical miniature station layout with passenger and goods accommodation. The platforms are served by two tracks forming passing loops, which are connected by Parallel Points to the single main line.

The island type of station has the merit that control of operations is centralised. The handling of luggage and traffic generally is facilitated, and the staff do not have to cross from one platform to the other in the course of their duties. On a miniature railway system, in addition to the advantages with regard to space, it is possible to obtain realistic effects with a smaller number of platforms and accessories than would be possible where two separate platforms are in use.

A disadvantage of the island arrangement in miniature is that its approach from the road has to be well arranged or much of the realistic effect at this point will be lost. Most Hornby Railway owners, however, are quite competent to model in cardboard or wood a suitable road overbridge incorporating the necessary station offices together with the sloping approach down to the platform. This is the usual arrangement where island platforms are employed in actual practice.



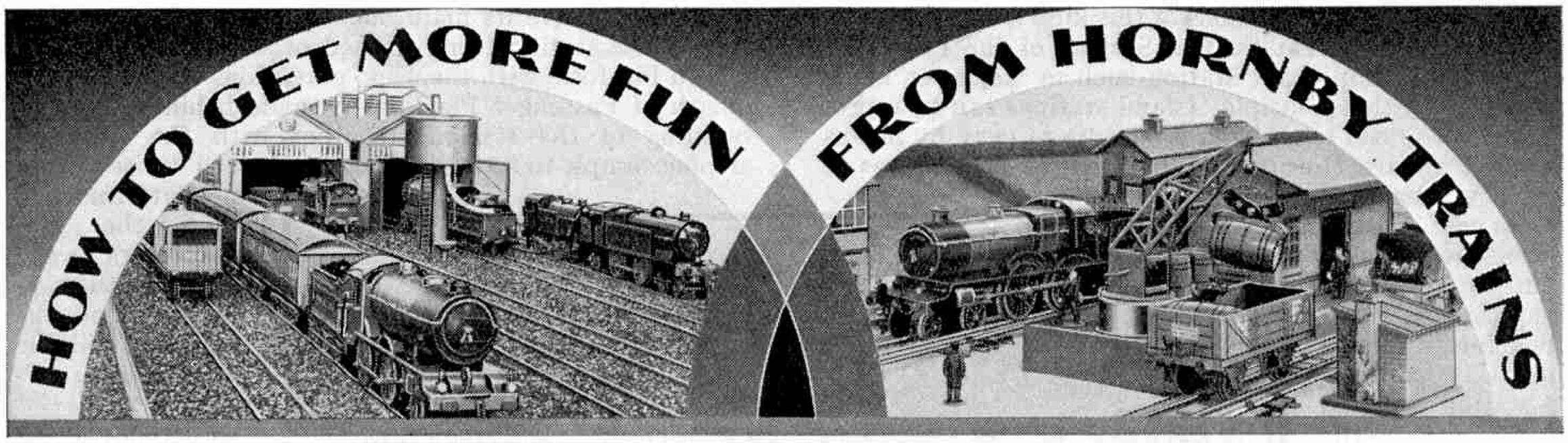
An effective station arrangement showing how the road approach may be formed at the rear of the station building by means of a Passenger Platform and ramps. The various Meccano Dinky Toys add considerably to the realism of the scene, as do also the Railway Accessories on the station platform.

This brings us to a point that is very often neglected by miniature railway owners, that is the question of making the road approach to their stations as realistic as possible. Sometimes space is against the incorporation of suitable effects of this kind, but where it is possible to do so the road approach should be correctly situated, and it may be made very effective. A possible scheme is shown in the lower illustration on this page. Here the station is arranged to have its main offices on one side, the other side of the station being formed of a length of Hornby Island Platform with the usual extensions. Good use of a length of Passenger Platform is made behind the main building of the station, together with the standard sloping ramps, to form the "road approach" raised up to the platform level. Then the two motor cars in the printed design of the rear of the station building appear at the correct level.

Further realistic effects are possible by the use of the motor cars that are available in the Dinky Toy range, together with miniature figures and one or two suitable accessories. This scheme is capable of a great deal of elaboration, according to the space and equipment available; and an up-to-date touch would be given by the inclusion of a miniature station "car park," which would be appropriately filled with Dinky Toy cars.

Where a large station serving three or more tracks is required, the Island Platform also can be usefully employed, for it serves two tracks at once, and in conjunction with the standard Railway Station some effective arrangements are possible. In a four-road station, for instance, the plan frequently found in actual practice can be closely followed. The two outer tracks are accommodated at the platforms of station "units" of the ordinary type, and the two main tracks are accommodated one on each side of an island platform. By using the standard Hornby Railway Station No. 2 for the outer tracks, and the Island Platform for the inner tracks, real practice can be reproduced exactly. Sometimes a four-road station is made up of a double island arrangement, each platform serving two tracks, and this again is possible owing to the ready adaptability of Hornby Railway material.

At junction stations where branch lines diverge the branch train can be dealt with on one side of an Island Platform, while the main line train with which it connects is accommodated at the other side. The rapid transfer of passengers and luggage from one to the other is thus possible, and the photograph on page 188 shows this scheme in operation. Trains on the other main line track use the platform provided by Railway Station No. 2.



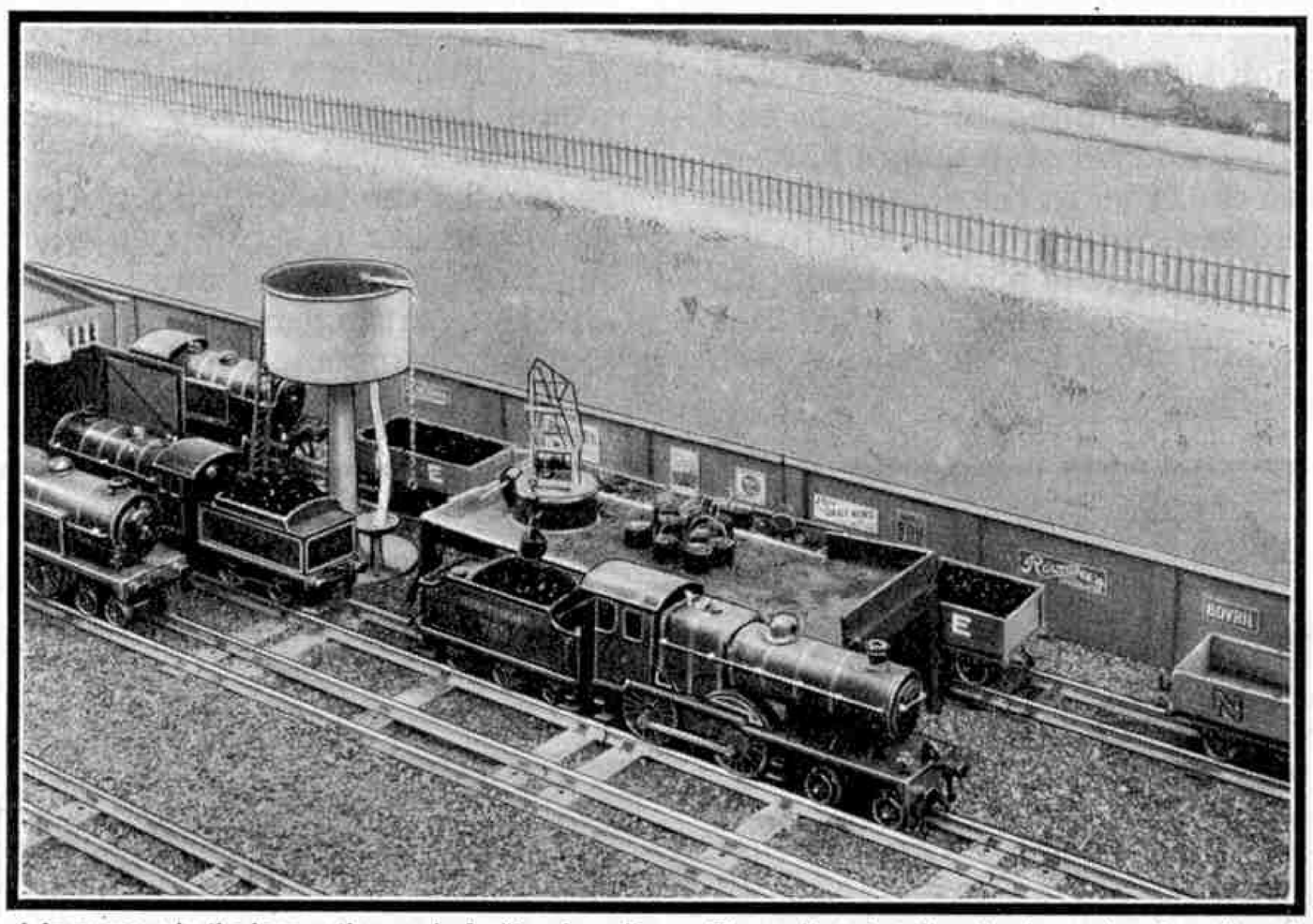
LOCOMOTIVE DEPOTS ON HORNBY RAILWAYS

DURING the operation of a miniature railway all the various items of rolling stock are not usually in use at one time. Those vehicles that are not actually running are usually left in the appropriate sidings on the line. Their storage thus in the sidings and their working out to form trains is quite in accordance with actual practice. With regard to the locomotive stock, however, this practice cannot very well be followed, having regard to the interests of realism. It is necessary, therefore, to provide appropriate engine sheds for their accommodation. Apart from the realism of accessories of this kind they are extremely useful, and in this article we intend to deal with the topic of locomotive depots in miniature, with special reference to the Engine Sheds of the Hornby Series, and to give suggestions for their arrangement.

When an engine shed is first obtained there is usually no difficulty in finding a suitable space for its accommodation. As a rule it is situated near the station, so that the locomotive is easily brought out and readily disposed of. With the extension of the system, however, it is often necessary to modify the original scheme of the line to some extent, and the claims of other stations on the line may require the establishment of a further shed. Alternatively, for a continuous track the scheme may be followed of combining the two sheds to form a central locomotive depot common to the whole system. The advantage here is that engines are kept together in one place, and their workings can be arranged and checked very easily.

This scheme is one that is favoured in actual practice nowadays, as locomotives can be handled more readily and supervision is easier at big centres, even at a cost of certain amount of running "light." The position of such a depot in miniature requires careful consideration, in order to equalise the amount of "light engine mileage" between the shed and the various traffic centres where engine duties "in traffic" commence.

In the ordinary way on a simple continuous layout quite a good position for the shed is in one corner of the space allotted to the line. Here the engines can be reached conveniently as a rule, even across the main line, from the central operating space. The shed, being a large building, this helps to fill up in a useful and realistic manner one of those corners whose obvious "squareness" is so hard to disguise effectively on a model railway.



A busy scene in the locomotive yard of a Hornby railway. The coaling stage is a simple wood and cardboard structure provided with a Platform Crane to deal with miniature "tubs" of coal.

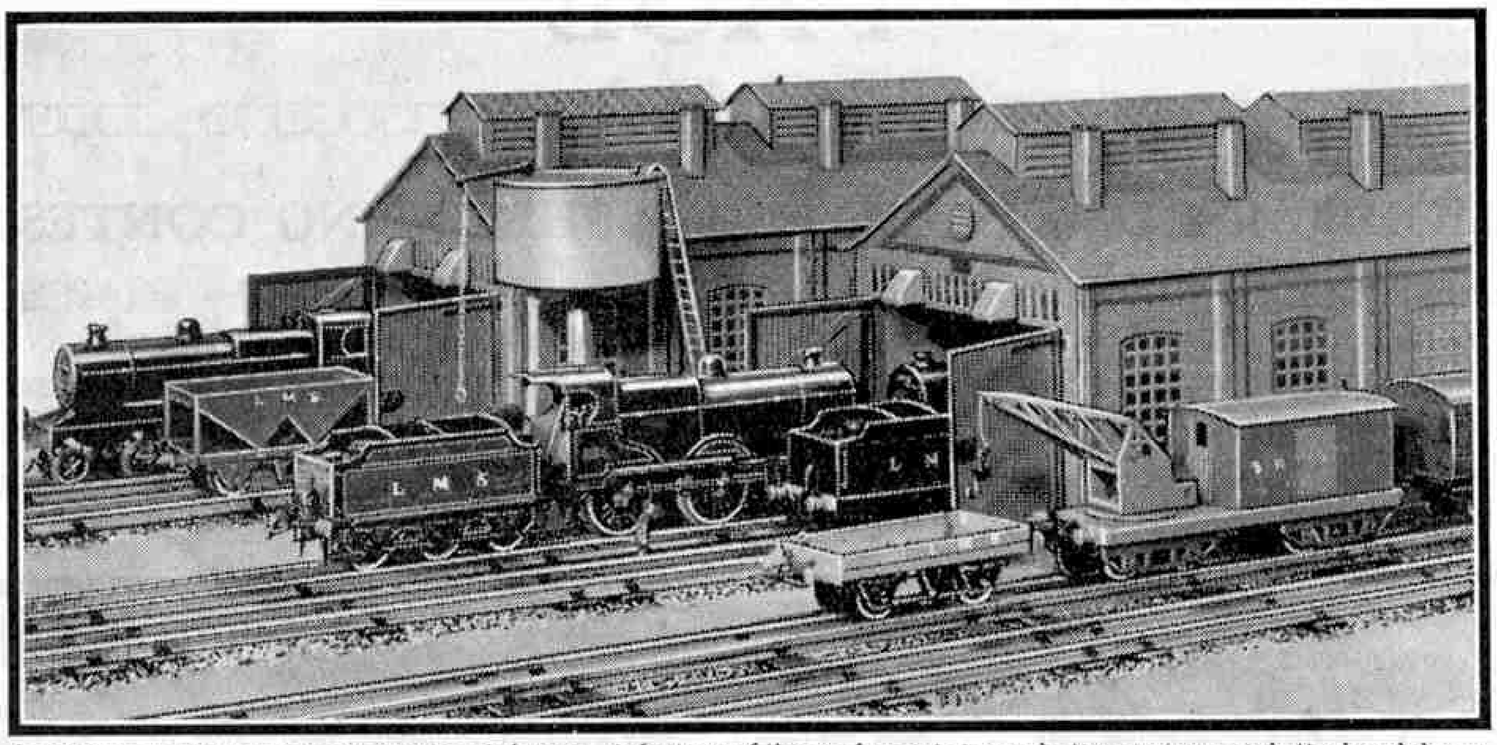
When the inevitable expansion of the layout occurs and it is neccessary to accommodate more engines, a problem at once confronts the model railway engineer. Space does not permit of the addition of the new shed "end-on" to the original one; nor can the two be used together side by side owing to lack of width. The most usual solution to this is to instal the new shed at the opposite end of the layout to the first one. The locomotive yard between them thus lies alongside the whole length of one side of the main line.

This is not at all a bad plan, for plenty of room is thus ensured for the movement of engines going on or off duty, and the locomotives can be divided among the two sheds according to their types, or the work that they are engaged on. One shed might be reserved for tender engines, and the other for tanks; or one might be for passenger and the other for goods locomotives. When the sheds are situated in this way the position of the turntable requires some thought. A position easy of access from both sheds is desirable, unless one shed is reserved for tanks, which do not require turning, and provided that the turntable does not form part of the track whereby the tank engines reach their shed.

The largest and most important Engine Shed in the Hornby Series is the No. E2E. This is a double-road

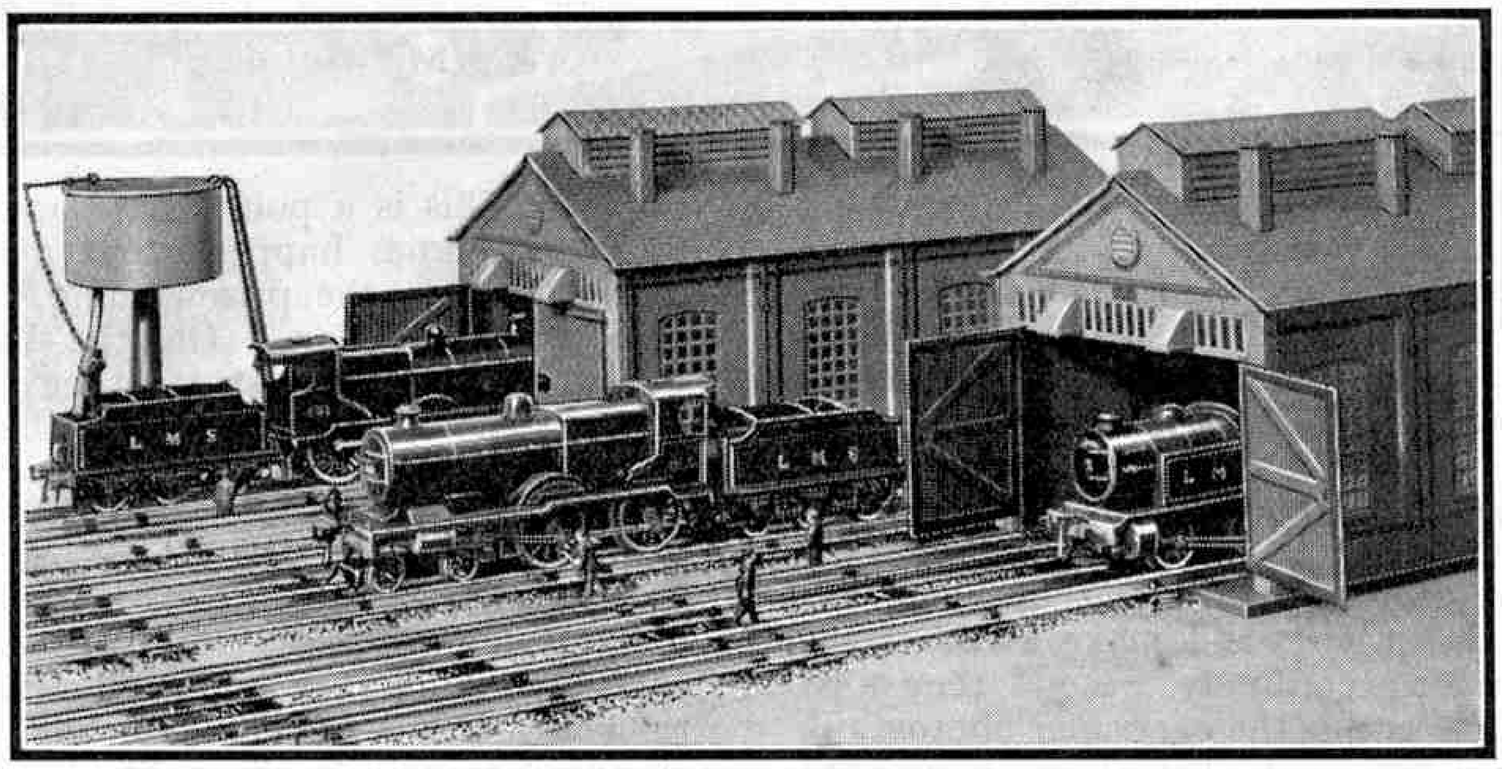
building, as are all the Hornby Engine Sheds, and will accommodate two of the largest Hornby Locomotives and their Tenders. This shed is intended for electrically-operated railways, and therefore has electric track laid inside. In addition it is one of the popular accessories fitted for electric lighting, and thus can be illuminated in a realistic manner.

The No. 2 Engine Shed is exactly the same except that it is intended for clockwork railways and so has no electrical equipment. A simpler version of these is also available in the No. 2A Engine Shed, which lacks the smoke troughs over the doors, and the chimneys in the roof, that the other two Sheds possess. It has a ventilator mounted on the roof, however, and is complete with double doors at each end, as in the case of the other Sheds, No. E2E and No. 2. Each of these three Engine Sheds will accommodate a locomotive and tender not exceeding 17½ in. in overall length.



An extensive motive power depot in miniature. A feature of the equipment shown in the photograph is the breakdown train in the foreground formed of Hornby components, that is ready for any emergencies requiring its use.

Where smaller locomotives are in use, and where space is restricted, smaller locomotive sheds are necessary. The Hornby No. E1E Engine Shed is the most elaborate of the smaller sheds that are available in the Series. This is in all respects a smaller version of the E2E Shed, and is intended for electric systems. It is therefore fitted for electric track and for illumination. Similarly the No. 1 Shed is a smaller version of the No. 2. The No. 1A Engine Shed is of the same dimensions as the other two small sheds, and will hold locomotives not exceeding 8¾ in. in overall length. It is simpler in its equipment, however, and instead of having doors at both ends it has one end closed up. This is therefore a particular useful accessory as a branch line shed where entrance at one end only is required. All the Hornby Engine Sheds are arranged to fit up to the standard Double Track.



A typical arrangement incorporating two Hornby No. 2 Engine Sheds. These are separated by two tracks and are assigned respectively to passenger and goods locomotives, as suggested in this article.

The equipment of the engine yard itself on a small scale is an interesting subject and offers great scope for realistic effect. Water tanks are of course an essential feature in a locomotive yard, and for preference, perhaps, the large No. 2 Water Tank should be used on locomotive depot premises, owing to its larger storage capacity; the new No. 1 Water Tank being kept for station and goods yard duties where there is not such a continuous demand for water. Provision for the fuelling of the engines must also be made. If it is desired to incorporate a more or less elaborate mechanical coaling plant on the lines of those frequently found in practice, Meccano parts may be useful employed for this purpose. Illustrations of Meccano models of this kind, and of the actual thing, have already appeared in the "*M.M.*" on several occasions.

For simpler equipment such as is found at the smaller and more remote centres, a type of coaling stage may be installed on the lines of that shown in the illustration on the opposite page. The stage may be served by a Platform Crane to transfer the "skips" from the wagon side of the stage to the engine berths. For the skips Meccano Chimney Adaptors or little tins or even small pill boxes can be employed. Any of these are quite effective when suitably painted.

An important part of the equipment attached to a depot, particularly if it is a large one, will be the breakdown train for dealing with any mishaps that may occur on the line. Breakdown equipment is often made use of also in actual practice in connection with any engineering work that may be going on that requires the service of a crane. The Hornby Breakdown Van and Crane is an effective piece of rolling stock, and with one or two ordinary Vans and a Guard's Van, and perhaps a Flat Truck as a runner wagon, a complete and realistic unit can be assembled. It should be kept in a siding reserved for it near the shed, ready to proceed instantly to the scene where and when its services are required.

In an emergency the breakdown train is hauled by the first engine with sufficient steam up that happens to be available. Fortunately on a Hornby Railway there are no waits for "steam raising" so that no delay will be occasioned on this account. Therefore, any engine near to hand may be pressed into service, unless the plan is followed of keeping an engine "standing pilot." Such an engine is ready for breakdown service in the event of any mishap, or it may be attached to any train as required, either to give pilot assistance, or to replace a locomotive that may have failed.

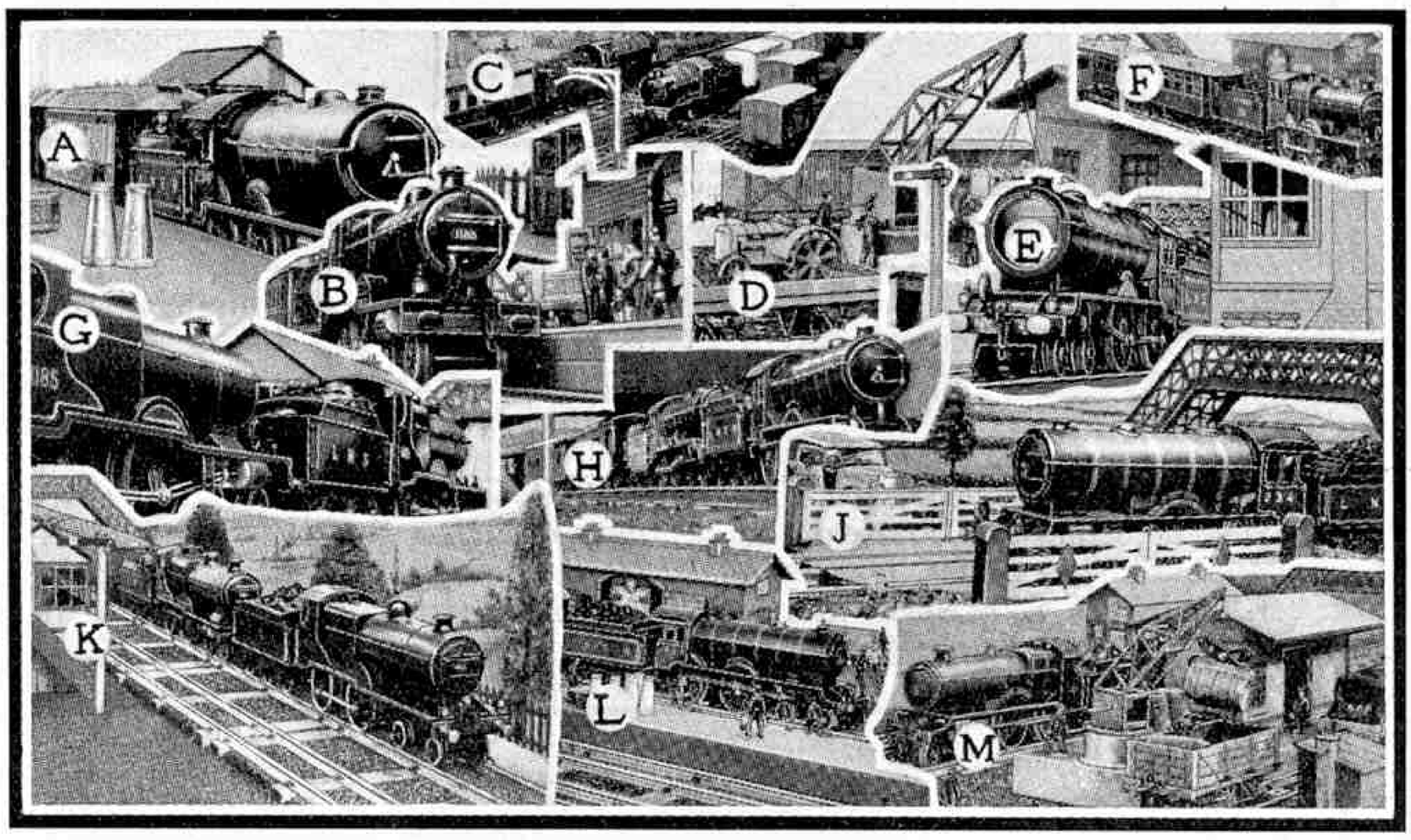
H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

MODEL RAILWAY PHOTOGRAPH VOTING CONTEST

In the "*M.M.*" each month are published photographs of model railway scenes, carefully selected to enable Hornby Railway enthusiasts to arrange and operate their miniature railways in the most useful and realistic manner possible. These illustrations may be divided broadly into two classes. The first consists of those in which the actual formation or situation is the point of interest, and little or no scenery is shown, the idea itself being thus kept clear and easy to follow. The other class includes illustrations in which the general realistic appearance is the main feature, and where the disposition of the trains, accessories and the surrounding country combine to form a complete and railwaylike picture.



The individual subjects dealt with in these H.R. photographs are very varied, and we should like to know which are considered the best by our readers. In order to ascertain this point we reproduce on this page 12 sections of typical examples of Hornby Railway photographs, and we invite readers to place these in order of merit.

Competitors are requested to do two things. First, they must decide upon the order in which they think the photographs should be placed, and make a list of the letters representing them accordingly. Second, they must state their reasons for selecting the particular photograph that they have placed first in the list. There is no need for this last item to be stated at great length; a few words will serve the purpose.

To the competitor who most accurately forecasts the total vote of all the competitors, a prize of Hornby Train goods (or Meccano products if preferred) to the value of 21/– will be awarded. To the senders of the three entries judged next in order of merit will be awarded similar goods to the value of 15/–, 10/6 and 5/– respectively. A duplicate set of prizes will be reserved for competitors in the Overseas Section. In the event of a tie for any prize the award will be made to the competitor whose entry is presented in the neatest or most novel manner. This is a point that should be borne in mind as it sometimes happens that a really good entry is displaced from the prizewinning list on account of its untidy presentation. On the back of entries submitted for this contest must be clearly indicated the sender's name, address and H.R.C. membership number.

Envelopes containing entries must be marked "*H.R.C. March Photo Voting Contest*" in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st March. Overseas competitors must post their entries so that they arrive at Headquarters not later than 29th June. Entries received after the published closing dates will be disqualified.

Railway Photographic Contest

This month we announce the fourth contest of the winter series of Railway Photographic Contests. Competitors are invited to submit photographs they took during the summer months or snaps of typical winter scenes. There are no restrictions with regard to the subject chosen and competitors may send as many prints as they desire, but no competitor can win more than one prize in one contest.

The contest will be divided as usual into two sections, Home and Overseas, and prizes of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four best Railway Photographs received in each section. In the case of a tie, for any prize, the prize money will be equally divided.

Envelopes containing entries must be marked "*H.R.C. March Photographic Contest*" in the top left-hand corner and posted to reach Headquarters at Meccano Limited, Binns Road, Liverpool 13, on or before 31st March. The closing date for the Overseas Section is 29th June.

COMPETITION RESULTS

HOME

December "Railway Strips Contest."—1. C. E. Wrayford (6039), Moretonhampstead, Devon. 2. R. Lynn (32449), Wisbech, Cambs. 3. J. C. Button (10335), Crewe. 4. R. Barbary (5580), St. Ewe, Mevagissey, Cornwall. Consolation Prizes: J. J. Horne (17501), Moreton-in-Marsh, Glos.; L. Parish (18054), Coventry; K. Costain (5108), Bolton.

December "Railway Photographic Contest."—1. D. H. Graham (24449), Bilton, Rugby. 2. P. Whitaker (36172), Chorlton-cum-Hardy, Manchester. 3. T. L. Cottrell (23234), Liberton, Edinburgh 9. 4. W. B. Hudson (1733), Weymouth.

OVERSEAS

September "Mixed Names Contest."—1. D. J. White (9333), Christchurch, N.Z. 2. R. A. Wragg (7913), Bandikui, India. 3. G. Hallack (17578), Capetown, S. Africa. 4. W. C. Moore (20918), Toronto, Canada.

HE USES IT MOSTLY!

"You ought to lend your scooter to your little brother sometimes."

"I do, auntie; he has it to go uphill, and I have it to go down."

* * * *

Temporary Postman (returning with parcel): "I've been from top to bottom of this street, and there's no house named 'Fragile'."

* * * *

Barber: "And how do you find the razor?"

Customer: "Didn't know I was being shaved."

Barber: "Very glad, I'm sure, sir."

Customer: "I thought I was being sandpapered."

* * * *

Householder (to tramp): "Tell me, where do you get washed?"

Tramp: "In the spring."

Householder: "I said where, not when."

* * * *

Mistress: "Why are you cleaning the inside of the window but not the outside?"

Maid: "Please, mum, so that you can look out, but the people outside can't see in!"

* * * *

"I always like to add a spice of danger to life."

"Is that why you eat peas with your knife?"

* * * *

"Give a man enough rope and he will hang himself."

"I gave mine plenty and he skipped."

* * * *

Jimmy (at his first concert, pointing to conductor): "Why is that man shaking his stick at the lady on the stage?"

Mother: "Sh-sh! He's not shaking it at her."

"Well, what's she hollerin' for, then?"

* * * *

"Now, you men," roared the sergeant-major, as he dismissed the company, "you will parade again at two o'clock precisely. And when I say two o'clock precisely, I don't mean five past. I mean five to."

* * * *

Father (at son's 21st birthday party): "Now that you are of age and drawing steady pay, I think you ought to help me a little."

Son: "Well, Dad, what can I do for you?"

Father: "You might pay the last instalments on the perambulator we bought for you when you were a child."

* * * *

TOO POLITE

Landlord: "Hi! What are you doing here? Can't you read? There's a notice over there by the gate."

Small boy: "I saw it, but it had 'Private' at the top, and I was too polite to read any further."

* * * *

Professor: "Can you tell me the earliest recorded reference to flying machines?"

Student: "Er—let me think, sir, didn't Esau agree to sell his heirship to Jacob?"

A LONG WAIT!

Waiter: "This coffee comes from Brazil."

Customer (who has been kept waiting): "So that's where you've been all this time."

* * * *

Amateur Photographer: "Have my films developed all right?"

Chemist: "The answer is in the negative."

* * * *

NOT A PATCH ON IT!

Busybody: "Why don't you tell your mother not to use such loud patches on your clothes? That one is nothing like the colour of your trousers."

Boy: "That's not a patch, missus. That's me."

* * * *

Grocer: "You want a pound of ochre? Is it red ochre for painting bricks?"

Small boy: "No, it's tappyoker wot ma makes puddin' with."

* * * *

Pat: "That was a foine sintiment Casey got off at the banquet last night."

Mike: "What was it?"

Pat: "He said that the swatest mimories in loife are the ricollictions of things forgotten."

* * * *

"It isn't sanitary to have the house built over the pigsty like that."

"Well, sir, we haven't lost a pig in fifteen years."

* * * *

Lady: "Do you stop at the Ritz?"

Bus Conductor: "Not on my salary, madam."

* * * *

"But darling, if your earache is better why do you keep on crying?"

"I'm waiting for daddy to come home; he has never seen me with earache."

* * * *

Pat: "Get me the correct time when you are in town, Mike."

Mike: "I'd be glad to, but I haven't got a watch."

Pat: "Can't you write it down on a piece of paper, you numbskull?"

* * * *

Lady: "I am sorry your husband is always singing; it must be annoying. My old man only sings about once a year."

Neighbour: "In his bath, I suppose."

* * * *

Bus Conductor: "This won't do; this sixpence has got a hole in it."

Passenger: "So has the ticket you gave me."

* * * *

Smith: "I want three lawn mowers."

Assistant: "Yes, sir; I presume you have a big estate."

Smith: "Nothing of the sort; I have two neighbours."

* * * *

"Name a liquid that doesn't freeze."

"Hot water, sir."

GOOD TESTIMONIALS

Foreman (on excavating job): "Do you think you are fit for really hard labour?"

Applicant: "Well, some of the best judges in the country have thought so."

* * * *

Lady (to tramp): "Why don't you work? Don't you know that a rolling stone gathers no moss?"

Tramp: "Lady, may I ask you what use moss is to a man in my condition?"

* * * *

Mother (returning home): "I hope my little boy has been as good as gold all day."

Nurse: "No. He went off the gold standard about teatime."

* * * *

Visitor: "Do all your men drop their tools the instant the whistle blows?"

Foreman: "Oh, no, not all of them: the more orderly ones have already put their's away."

* * * *

Servant (answering bell): "My master isn't in, sir. You may leave the bill if you wish."

Caller (in surprise): "Bill? I have no bill. I wish to—."

"No bill! Then you must have called at the wrong house."

* * * *

"What do you mean by 'beastly weather'?"

"When it's raining cats and dogs."

* * * *

"Waiter, look here, there's a hook and eye in this salad."

"Yes, sir, that's part of the dressing."

* * * *

Two flies were walking over the head of a bald man. "How things change," said one. "I can remember when there was only a narrow footpath here."

* * * *

"I wish I had a million pounds. I'd go to the cinema every day then."

"You'd take me with you, wouldn't you?"

"No. If you're too lazy to wish for yourself, you can stay at home."

* * * *

Office-boy: "May I have overtime money this week, sir?"

Employer: "Whatever for?"

Office-boy: "I dreamt about my work all last night, sir."

* * * *

NOT HIS FAULT!

Gentleman: "Just a minute, sonny. Are you a telegraph boy?"

Boy: "No, sir. It's my bad foot makes me walk so slowly."

* * * *

Smith: "I've a very rare typewriter that was owned by Napoleon."

Jones: "Don't talk nonsense, typewriters weren't invented in Napoleon's time."

Smith: "That's what makes the machine so rare."

Does **YOUR** dog give the

DANGER SIGNAL?

He cannot speak but he can give warning signals—readily apparent to the observant dog lover. Such signals are listlessness, loss of appetite, dry nose, and sulkiness. Then is the time he requires BENBOW'S DOG MIXTURE to ensure an "all clear" run of health.

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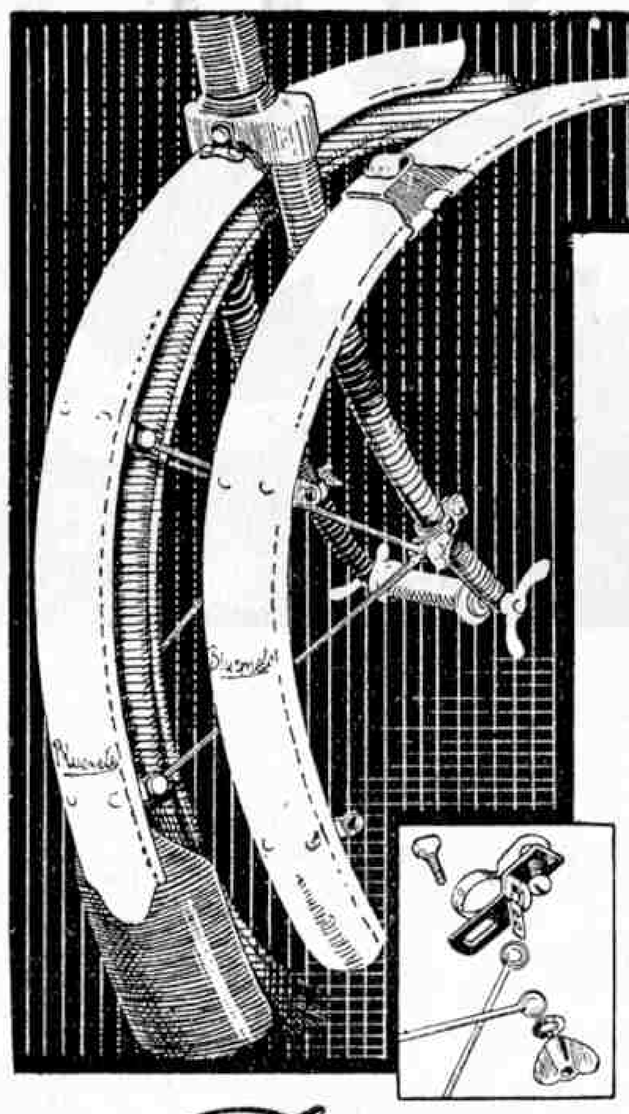

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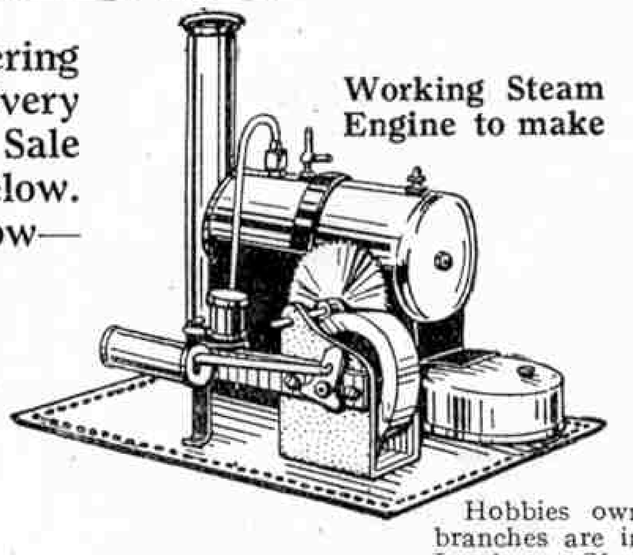
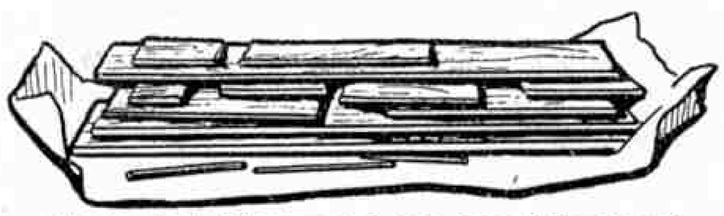


Working Steam Engine to make



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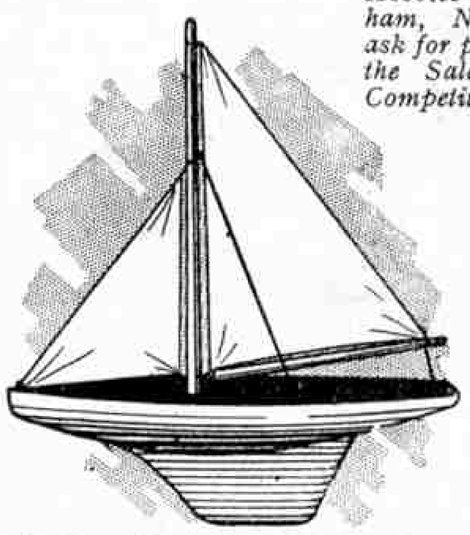

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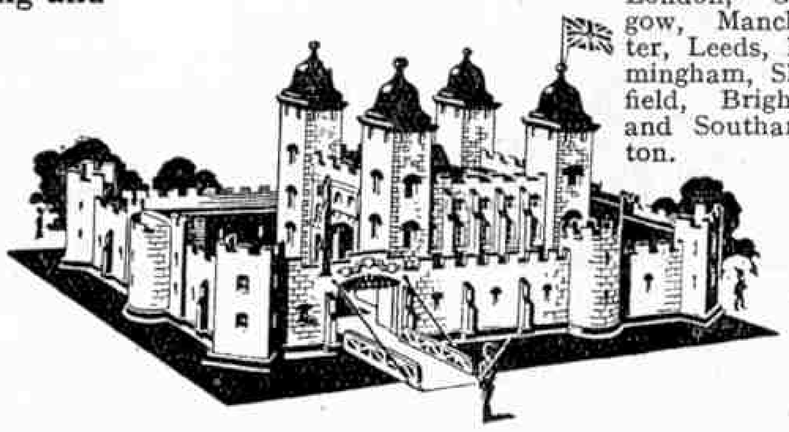


This Toy Fort to make in wood at specially reduced price

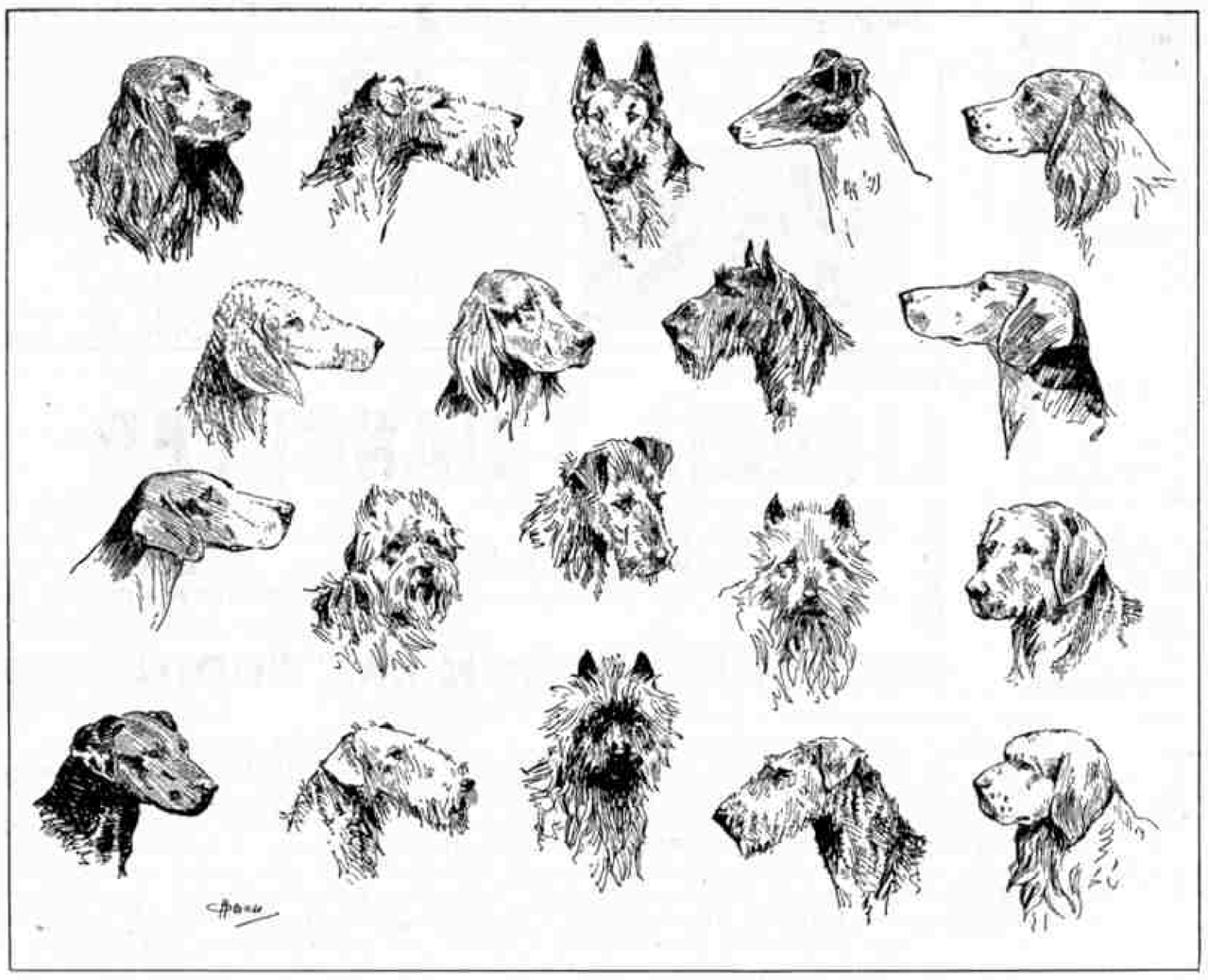
Competition Corner

CAN YOU IDENTIFY THESE DOGS?

We have had in the *"M.M."* many different forms of competitions calling for the use of sharp eyes, but never before have we featured animals. Most boys love dogs, however, and very many of our boy readers own one. For those reasons we think this month's competition will prove of exceptional interest and popularity.

Our illustration shows the heads of 19 typical representatives of well-known British breeds of dogs, and readers are invited first of all to identify the individual dogs, and then, in from 50 to 100 words, to say which of them they like best and give their reasons for the choice.

Prizes of Meccano products—an expression that covers all articles listed in our current catalogues—to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four readers who succeed most nearly in identifying the 19 dogs. In the event of a tie for any or all of the prizes, regard will be had to the second part of the entry explaining the competitor's choice of dog.



Several very popular British breeds have been omitted from the illustration, since their inclusion would have tended to make the contest simple. Those competitors whose personal preference for a dog lies outside the breeds shown, may take their special favourite as their subject for the second part of the contest.

Entries must be written on one side of the paper only, and the competitor must place his name and address at the head of each sheet used. Reference to the dogs should take them in the order of their appearance in the illustration, top row first, proceeding from the left to the right.

The entries should be addressed to "Dog Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th March.

A similar set of prizes will be reserved for entries from Overseas readers—those living outside the United Kingdom, Northern Ireland, and the Channel Islands. Overseas entries must arrive not later than 29th June.

March Drawing Contest

For our drawing competitions this winter we have decided to give our readers a free choice in the matter of subjects, and accordingly prizes are being offered each month for the best drawings or paintings submitted, irrespective of subject, size of the entry, or method of production.

Each month's entries are divided into two sections, A for those aged 16 and over, B for those under 16, and prizes of Meccano products to the value of 21/– and 10/6 respectively, are awarded in each section.

A separate set of prizes is reserved for entries from Overseas readers, to be awarded in precisely the same conditions.

In making their awards the judges give due consideration to the ages of the individual competitors. It is important, therefore, that each entry should indicate the competitor's age, in addition to his name and address.

Entries to the March Contest must be addressed "December Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th March. Overseas closing date, 29th June.

F	L	A	G	R	A	N	T	■	B	R	I	D	G	E
L	■	T	E	A	S	E	■	■	■	■	R	■	■	A
A	■	T	E	M	P	E	S	T	■	B	A	S	I	S
G	■	I	S	■	■	D	■	A	■	■	T	E	N	T
■	■	R	E	P	E	L	■	L	A	M	E	N	T	■
G	■	E	■	■	■	E	■	U	■	■	■	S	E	T
L	E	S	S	O	N	S	■	S	I	N	C	E	R	E
A	■	■	■	■	■	■	■	■	■	■	■	■	■	A
R	E	S	C	U	E	S	■	C	R	E	E	P	E	R
E	A	T	■	■	■	T	■	O	■	■	■	R	■	S
■	G	R	A	N	G	E	■	N	O	I	S	E	■	■
C	L	A	P	■	■	E	■	S	■	■	A	S	■	B
R	E	P	A	Y	■	P	R	O	L	A	T	E	■	R
O	■	■	R	■	■	■	■	L	A	T	I	N	■	A
P	O	R	T	A	L	■	R	E	P	E	N	T	E	D

The Overseas section now having closed, we give above the solution to the November Crossword Puzzle. In the judging, the words BRAD and STUD were accepted as fulfilling clue 38 down.

Unsuccessful entries will be returned if a stamped addressed cover of suitable size is sent with the entry.

COMPETITION RESULTS

HOME

Advertisement Jig-Saw Contest.—1. D. M. Davies (Maesteg); 2. W. A. Bradshaw (Sheffield); 3. D. Egar (Wolverhampton); 4. R. V. Briggs (Wallasey). Consolation Prizes: A. Bruce (Cleadon); K. H. Cheadle (London, S.W.11); C. A. Fawcitt (Leeds); C. Harvey (Gidea Park); F. Hindshaw (Salford); W. H. Lloyd (Rhymney); S. F. Matthews (Preston); J. B. Roberts (Glasgow); D. W. Robinson (London, W.14); S. A. Sewell (Bromley); N. Weight (Tankerton); G. Willan (Manchester).

Cover Voting Contest.—1. J. C. Thompson (Keighley); 2. W. Hudson (Weymouth); 3. A. Bass (Woodford Green); 4. F. Barker (Leeds). Special Prize: P. Stedman (Plymouth).

January Drawing Contest.—First Prizes: Section A, K. Costain (Bolton); Section B, F. Clarke (Hull). Second Prizes: Section A, F. Wright (Gateshead); Section B, A. Norman (Campbeltown); H. Ward (Sheffield); C. Ware (London, E.11).

OVERSEAS

Point Words Contest.—The entries to this competition once again showed that our readers are greatly intrigued by this form of word competition. Unfortunately, several good entries were spoiled by the inclusion of ineligible words such as proper nouns. The winning entry achieved a score of 80 points.

The prizes were awarded as follows: 1. D. J. White (Christchurch, N.Z.); 2. J. A. Rodriguez (Montreal); 3. G. R. Churches (Heilbron, O.F.S.); 4. J. A. Churches (Heilbron, O.F.S.).

October Drawing Contest.—First Prizes: Section A, D. E. Yockney (Auckland, N.Z.); Section B, R. Dickison (Dunedin, N.Z.). Second Prizes: Section A, W. F. Bladergroen (Amsterdam); Section B, M. Conly (Dunedin, N.Z.).

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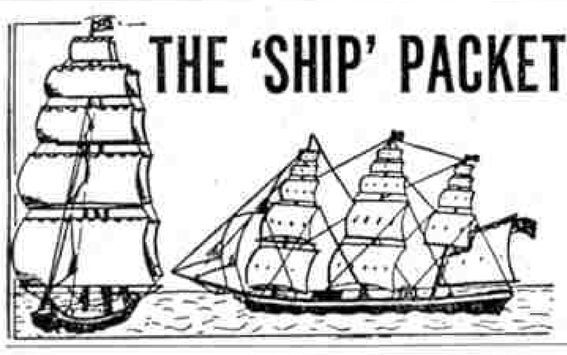

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5	Azores ...	2d.	10	,,	5d.
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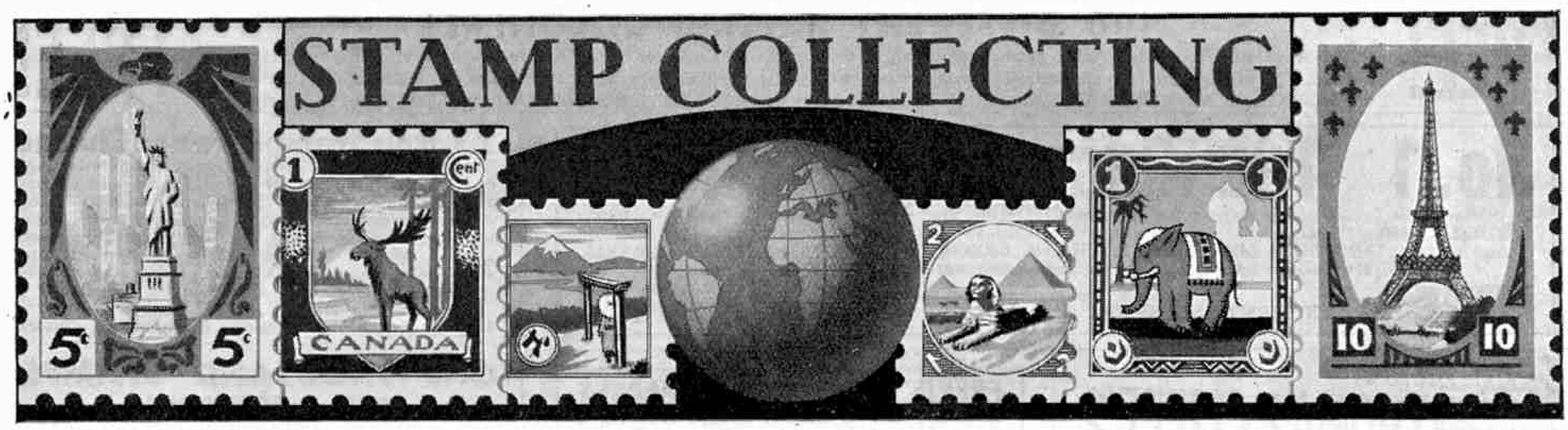


THE ANATOMY OF A STAMP

DURING recent months our stamp pages have been devoted to helping readers to secure the neat, intelligent display of their stamps. This month we deal with a subject that is of importance to every collector who is really keen on his hobby, namely, the technical processes of stamp production.

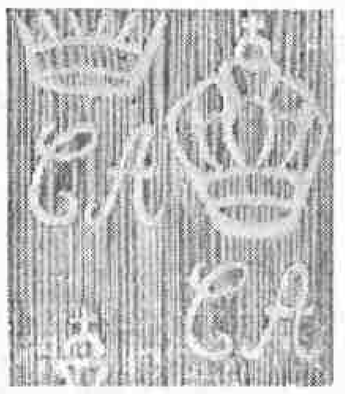
It is through these processes that there arise the varieties that are of such great interest to both the general collector and the specialist. The general collector must have some knowledge of production processes, lest he should entertain unawares some rare specimen that differs only slightly from the normal items from the same issue. In this and in many other directions some knowledge of the various papers employed, and of watermarks, printing processes and perforations, may be of great value.

The commonest varieties of paper that are encountered are known technically as *wove* and *laid*. A wove paper may be distinguished by the evenness of its texture, like that of the paper employed in the printing of the "*M.M.*" It is without any special distinguishing feature, and it is used for a very large proportion of modern stamp issues. Laid paper can be identified by parallel watermark lines running vertically or horizontally across the paper. Another stamp paper is known as *granite*, and derives its name from minute flecks of coloured fibre in the paper. These are easily visible to the naked eye. A fourth type of paper is known as *pelure*, a thin semi-transparent paper of considerable strength. The term nowadays is very loosely applied to any kind of thin paper, irrespective of its toughness. A more uncommon variety of paper is known as *quadrille*. Its distinguishing feature is a network of watermark lines running vertically and horizontally to form a pattern of squares or rectangles.

Rarely to-day does a modern issue appear on paper unprotected from forgery by some watermark device in the texture. At one time it was more or less customary to prepare the paper so that a single watermark appeared in each stamp. The Great Britain "Spray" watermark, used in the 1870s, illustrated here, is a case in point. This method necessitated exceedingly careful registration of the printing plates and the paper, and nowadays to avoid this additional trouble multiple watermarks are employed. These are small designs such as the *multiple script C.A.* in the current British Colonial issues, which also is illustrated; and they are worked into the whole of the sheet of paper so that each device appears partially or completely several times on each stamp.

Most watermarks are easily visible by holding the stamps up to the light, but if the mark cannot be seen in this manner it will show up when the stamp is placed face downward on the black surface of a watermark detector and saturated with a drop or two of benzine. In examining watermarks it is important to remember that the mark reads from left to right, just as the stamp design. Therefore, when the mark is examined from the back of the stamp, it is seen in reverse form.

The surface of the paper is usually specially prepared to present a good printing surface and, more important still, to prevent the removal of postmarks from used stamps. Thus we get chalk, enamelled and tinted surfaces. The first two are similar in appearance, but the difference between them can be detected by rubbing their surfaces with the edge of a silver coin. On a chalky specimen a fine pencil-like line is produced, but the enamelled paper will not respond.



Tinted surface stamps, known as "white-backs," appear quite frequently in British Colonial issues. One issue, among many that come to mind, is the New Zealand Dunedin Exhibition series of 1927. The three stamps were respectively yellow-green on green, carmine on rose, and mauve on pale mauve. The Dunedin Exhibition stamps were also treated very heavily with chalk.

The object of the elaborate precautions of which we have given a brief outline is to defeat the would-be forger. A further precaution in this direction is the use of what are known as "fugitive" inks. These inks are affected very badly by moisture, which robs of their brilliance the aniline colours that are used. On this account it is very important, when floating stamps of this type off their backing paper, not to allow the moisture to penetrate through to the front of the stamp. The backing paper should be soaked only to a sufficient extent to wet the gum, and then, provided due care is taken, the stamp may be pulled away quite easily and without damage.

It is in the printing of stamps that the majority of varieties arise. These varieties are known as *shades*, and are due to slight differences in the action of the printing ink. Although successive printings may vary very little indeed from their immediate predecessors, it is not infrequent that quite important variations appear as between one stamp and another of nominally the same type and colour, issued with long intervals between them. For example, the stamps of the Great Britain King George issues show some very slight variations.

Such minor variations, of course, are entirely different from intentional alterations, such as were witnessed some years ago when all the British Colonial 1d. stamps were changed from carmine to scarlet, and the ½d. Great Britain from blue-green to yellow-green. These changes must be noted by every collector, but unintentional minor varieties may be disregarded by all save the specialist.

There are several distinctive methods of printing, but the processes principally employed are line engraving (sometimes known as intaglio or recess printing), surface printing (typography), lithography and, to a greatly increasing extent, photogravure. In the March "*M.M.*" last year we dealt very extensively with the printing of stamps, and new readers who are desirous of reading that article can obtain copies from the Publishing Department, price 8d. post free.

In the early days of stamps, the sheets were issued to Post Offices without provision being made for separating one stamp from another, and cutting with scissors was the only method of separation. As the demand increased, the unsatisfactory nature of this arrangement

(*Continued on page 199*)

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The "1,000 Packet" contains 500 excellently assorted Stamps; a **Complete Sheet of 100 Unused** (very useful for exchange purposes); a neat 12-page booklet for holding duplicates; 25 British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues; 375 Magic "Strip" Mounts, which mount stamps three times as quickly as the old-fashioned single ones; my price list of stamp bargains. In addition, free sets will be sent to those who send names of stamp-collecting friends. *Ask for my famous Approvals.* "B.O.P." and "Captain" monthly parts cheap; also 24 bound volumes of "Chums." Write for particulars.

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H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET

Stamp Collecting—*(Continued from page 197)*

became more and more apparent, and the perforating machine came into being. There are three principal types in use. The "comb" machine has its perforating pins so arranged that they perforate one long line and a number of short ones at right angles in one blow. Sheets perforated by a comb machine can be distinguished by the fact that the margin at the bottom of each sheet is perforated at right angles to its edge. "Single line" machines perforate one line at a time, and when all the lines across the sheet have been completed, the sheet is turned and the side perforations are made. The third machine is known as the "harrow." This perforates the whole of the sheet of stamps in one blow, the pins being laid out in rectangles so that they have the appearance of the agricultural harrow.

Perforations are of importance, in that a variation in the number of perforations to each stamp often indicates the introduction of a new machine, and therefore assists in putting an approximate date on the appearance of any particular stamp of a design that has been employed for a long time. The standard of perforations is the number of holes that appears in a space of two centimetres. Thus the description Perf. 12½ means that the stamp is perforated all round with 12½ perforations to every two centimetres. If the spacing at the top and sides varies, it is customary to indicate the top figure first; thus 12½ × 13 means that the perforation along the top is 12½ and down the sides 13.

Any stamp dealer can supply a perforation gauge marked with rows of black dots that fit exactly into the perforated holes. To find the perforation number of a stamp, move its edge up and down these rows until the dots in one of the rows fit the side of the stamp. The figure on the gaug alongside that row gives the perforation number.

Another system of separating stamps is rouletting, which differs from perforating in that no paper is actually cut away from the sheet. What is known as a normal roulette consists of a series of short straight cuts made by a toothed wheel. There are also zigzag, serpentine and saw roulettes, each of these terms being descriptive of the actual arrangement of the cuts.

The last feature of stamp anatomy to come under review is the gum, but this is not a feature calling for extensive study. An examination of the gum is necessary only when a variation in colour enables the collector to distinguish between stamps printed at different periods or between genuine and doubtful stamps.

Stamp Gossip

and Notes on New Issues

The Gordon Memorial Issue

This month we are able to illustrate the Sudan issue commemorating the 50th anniversary of the death of General Gordon, who was killed on the steps of Government House at Khartoum on 26th January, 1885, during the siege by the fanatical Mahdi, two days before Kitchener's relief force arrived.

The portrait of General Gordon illustrated here, showing him wearing the Egyptian *tarboosh*, is used on all the four lower values 5 mils to 15 mils.

The high values, 20p. and 50p., show the scene at the first memorial service to Gordon, held 13½ years later in front of the ruins of Government House. Lord (then Sir Herbert) Kitchener, Sirdar of Egypt, had at last succeeded in crushing the Sudanese rebels at the battle of Omdurman, and his first act on entering Khartoum was to hold this memorial service to Gordon. The stamp design shows Kitchener and a contingent of his forces, together with the four army chaplains, Anglican, Presbyterian, Roman Catholic and Wesleyan, who jointly conducted the service.

The third design, used for the 2p., 5p. and 10p. stamps, shows the Gordon Memorial College founded by Kitchener as the most suitable permanent memorial to Gordon. Kitchener appealed for £100,000 to found a school "which would provide most practical useful education possible to boys for their future in the Sudan." The required money was subscribed within a month, and the school was opened in November, 1902.

Eat More Fruit!

Roumania recently held a National Fruit Week, and as part of the propaganda two stamps were issued, 1 and 2 leu values. The design used for both stamps showed a young girl stretching up her arms towards a bunch of grapes hanging on a vine.

* * *

A movement is on foot to secure the absorption of South West Africa into the Union. Since 1920 the territory, formerly a German Colony, has been administered by the Union Government under a League of Nations mandate. The elections of the Legislative Assembly are held once in every five years, and at the recent election the United party —non-German—gained the necessary two-thirds majority to enable it to apply for permanent inclusion in the Union.

The MacArthur Centenary

We illustrate here the design of Australia's MacArthur centenary issue to which we referred briefly in the February "*M.M.*"

Captain John MacArthur was the founder of the Australian wool industry. In 1797 he imported four or five Merino ewes and three Merino rams from the Cape of Good Hope, and with this small flock established the first Australian sheep farm. In 1827 wool from his flocks achieved a world record market price, and from that point Australia's wool industry has increased by leaps and bounds.

It is the centenary of his death in 1834 that is celebrated by this stamp issue, which comprises three values, 2d., 3d., and 9d., each of them bearing the design illustrated here, showing a prize Merino ram, with a typical sheep "run" as its background.

Australia's New Air Stamp

The general opinion of Australia's new 1/6 air stamp used for the first time in the special Christmas air mail will be highly complimentary, for it is indeed a beautiful piece of stamp production. As our illustration shows, the design depicts Mercury —the "messenger" of the ancient Greek Gods—winging his way across the hemispheres.

* * *

Among our stamp illustrations this month there are two from the Swedish series commemorating the fifth centenary of the foundation of Sweden's Parliament. These are the 35 öre value, showing a view of the Houses of Parliament, and 60 öre value, showing a group of representatives of the Four Estates, the original constituents of the Government, the Nobility, the Clergy, the Burghers and the Peasants.

Forthcoming Colonials

The movement in Colonial stamp design from the simple King's Head design to the purely pictorial is rapidly gaining impetus, and following the Cyprus issue, specimens from which are illustrated in this issue, there are to come full issues for the Cayman Islands and for the new postal administration of Kenya, Uganda and Tanganyika. We hope to give next month full details of these impending issues.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

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Meccano parts, many of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics may be correctly reproduced.

New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual engineering practice. Ask your dealer for the latest complete illustrated price list.

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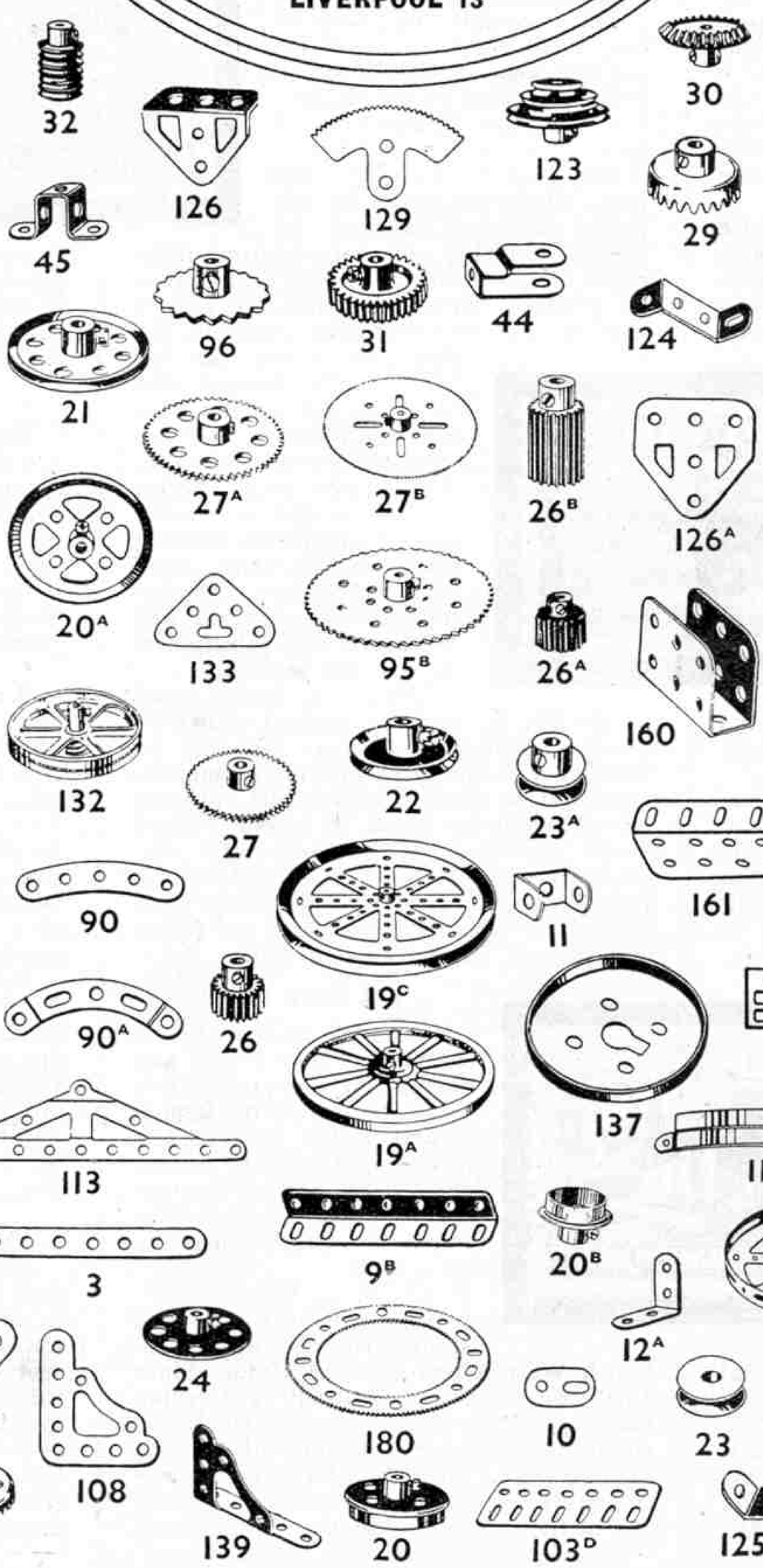
PRICES OF PARTS ILLUSTRATED

No.			s.	d.
3.	Perforated Strips, 3½″	½ doz.	0	4
9b.	Angle Girders, 3½″	,,	0	8
10.	Flat Brackets	doz.	0	2
11.	Double Brackets	,,	0	6
12a.	Angle Brackets, 1″ × 1″	½ doz.	0	4
19a.	Wheels, 3″ diam., with set screws	each	0	6
20.	Flanged Wheels, 1⅛″ diam.	,,	0	5
20b.	,, ,, ¾″ ,,	,,	0	3
	Pulley Wheels			
19c.	6″ dia. with centre boss and set screw	each	1	9
20a.	2″ ,, ,, ,,	,,	0	4
21.	1½″ ,, ,, ,,	,,	0	4
22.	1″ ,, ,, ,,	,,	0	3
23a.	½″ dia. with centre boss and grub screw	,,	0	3
22a.	1″ dia. without centre boss and grub screw	,,	0	2
23.	½″ ,, ,, ,,	,,	0	2
24.	Bush Wheels	,,	0	4
26.	Pinion Wheels, ½″ dia., ½″ face	,,	0	4
26a.	,, ,, ½″ ,, ½″ ,,	,,	0	5
26b.	,, ,, ½″ ,, ¾″ ,,	,,	0	6
	Gear Wheels			
27.	50 teeth to gear with ¾″ pinion	each	0	5
27a.	57 ,, ,, ,, ½″ ,,	,,	0	6
28.	Contrate Wheels, 1½″ diam.	,,	0	9
29.	,, ,, ¾″ ,,	,,	0	6
30.	Bevel Gears, ⅞″, 26 teeth	,,	0	7
30a.	,, ,, ½″, 16 ,,	,,	0	6
30c.	,, ,, 1½″, 48 ,,	,,	1	6
	(30a and 30c can only be used together)			
31.	Gear Wheels, 1″, 38 teeth	each	0	10
32.	Worms	,,	0	4
44.	Cranked Bent Strips	,,	0	1
45.	Double ,, ,,	,,	0	1
46.	,, Angle Strips, 2½″ × 1″	½ doz.	0	6
55.	Perforated Strips, slotted, 5½″ long	doz.	1	6
61.	Windmill Sails	4 for	0	6
77.	Triangular Plates, 1″	each	0	1

PRICES OF PARTS ILLUSTRATED (Cont.)

No.			s.	d.
90.	2½″ Curved Strips, 2⅜″ radius	each	0	1
90a.	2½″ Curved Strips, cranked, 1⅜″ radius, 4 to circle	,,	0	1
95b.	Sprocket Wheels, 56 teeth, 3″ diam.	,,	0	6
96.	Sprocket Wheels, 18 teeth, 1″ diam.	,,	0	3
99.	Braced Girders, 12½″ long	½ doz.	2	6
102.	Single Bent Strips	each	0	1
103d.	Flat Girders, 3½″ long	½ doz.	0	7
108.	Architraves	doz.	1	6
110.	Rack Strips, 3½″	each	0	2
113.	Girder Frames	,,	0	3
118.	Hub Discs, 5½″	,,	1	3
119.	Channel Segments (8 to circle, 11½″ diam.)	,,	0	4
123.	Cone Pulley	,,	1	3
124.	Reversed Angle Brackets, 1″	½ doz.	0	4
125.	,, ,, ,, ¾″	,,	0	3
126.	Trunnions	pair	0	3
126a.	Flat Trunnions	each	0	1
129.	Rack Segments, 3″ diam.	,,	0	5
132.	Flywheels, 2¾″ diam.	,,	2	0
133.	Corner Brackets, 1½″	,,	0	1
133a.	,, ,, 1″	,,	0	1
137.	Wheel Flanges	,,	0	3
139.	Flanged Brackets (right)	,,	0	2
143.	Circular Girders, 5½″ diam.	,,	1	0
145.	Circular Strips, 7½″ diam. over all	,,	0	9
147.	Pawls, with Pivot Bolt and Nuts	,,	0	3
148.	Ratchet Wheels	,,	0	6
154a.	Corner Angle Brackets, ½″, right hand	½ doz.	0	6
154b.	Corner Angle Brackets, ½″, left hand	,,	0	6
160.	Channel Bearings, 1½″×1″×½″	each	0	2
161.	Girder Brackets, 2″×1″×½″	2 for	0	3
167.	Geared Roller Bearings	each	20	0
168.	Ball Bearings, 4″ diam.	,,	3	0
170.	Eccentrics, ¼″ throw	,,	0	9
180.	Toothed Gear Ring, 3½″ diam. {133 external teeth / 95 internal ,,}	,,	2	0



HORNBY SERIES

HORNBY ROLLING STOCK

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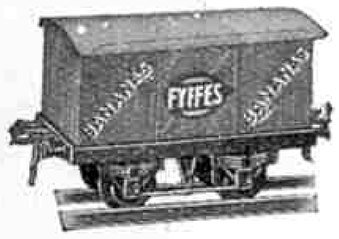
Now is the time to add to your Hornby Railway. Every boy knows that a real railway system is constantly expanding and developing. New rolling stock and new equipment are added; new tracks are laid; new stations, signal cabins and goods sheds are built; new tunnels and viaducts are constructed—every effort is made to cater for modern requirements. Your Hornby railway, too, can be run in the same progressive manner. One by one you can add Coaches, Trucks, Wagons and Vans of the latest types; and Stations, Signals, Bridges, Turntables and Engine Sheds that will gradually convert your present Hornby railway into a really fine model railway system.

Ask your dealer to show you the full range of Hornby Rolling Stock and Accessories.

OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/-**

PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/-**

BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**

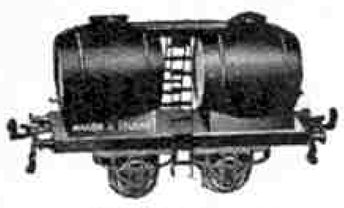


BANANA VAN
An attractive model, finished in yellow and green. Price **2/9**

MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **2/11**

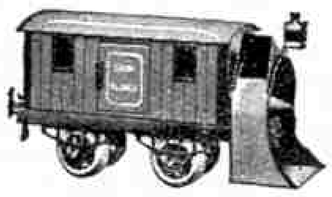
***OPEN WAGON "B"**
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail. Price **2/-**

SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/-**

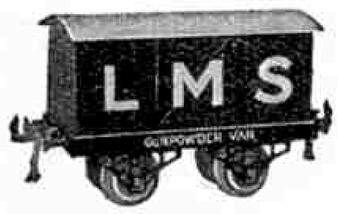


WINE WAGON DOUBLE BARREL
An attractive model artistically enamelled in red and green. Price **4/6**

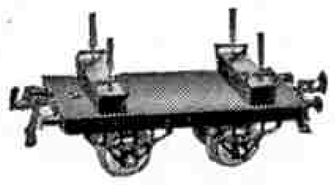
TIMBER WAGON No. 1
Beautifully enamelled in yellow and red. Price **1/6**



SNOW PLOUGH
With revolving plough driven from front axle. Price **3/9**



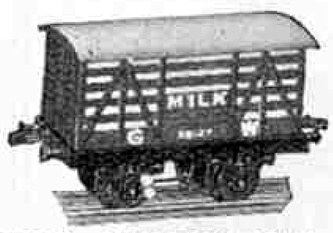
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **2/9**



LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **1/6**

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **3/6**

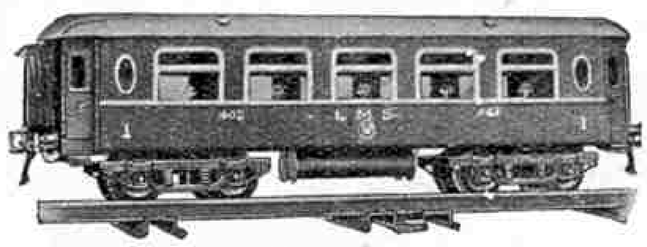
MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**



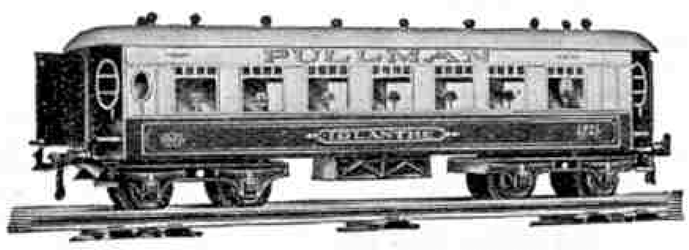
MILK TRAFFIC VAN No. 0
An attractive model. Available lettered G.W. only. Price **1/11**

COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**

MITROPA COACH No. 3
Lettered "Mitropa," with either "Spiesewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **12/6**

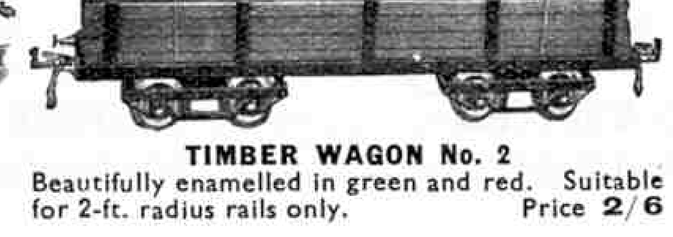


No. 2 SALOON COACH
Realistic in design and beautifully finished Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **9/6**

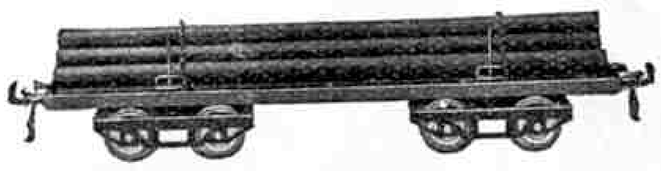


HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **13/-**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **3/11**



TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **2/6**

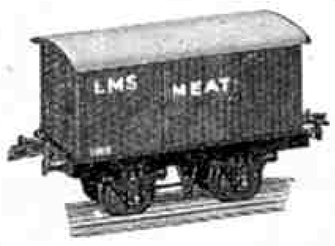


LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **2/11**

* *In L.M.S., L.N.E.R., G.W. or S.R. lettering.*

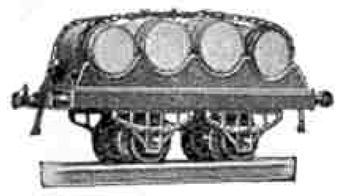
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/-**

OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/-**



MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **1/11**

FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/3**

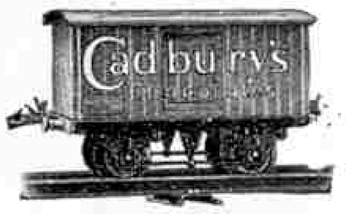


BARREL WAGON
This is another interesting model of a type of wagon used in France and other European counries. Price **2/6**

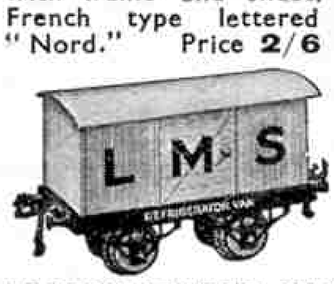
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **1/11**

COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **2/6**

ROTARY TIPPING WAGON No. 1
Finished in orange. Price **2/6**

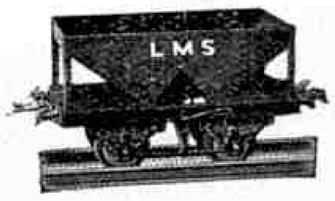


CHOCOLATE VAN "CADBURY'S"
This new van is beautifully enamelled in blue with orange roof. Price **2/9**

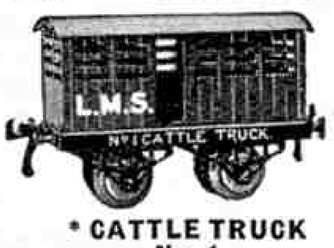


*** REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **2/9**

CRANE TRUCK
Finished in brown and blue. Price **2/11**



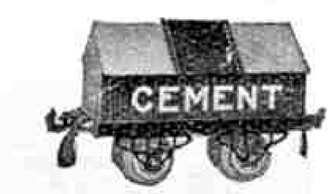
*** HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**



*** CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **2/9**

MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **4/6**

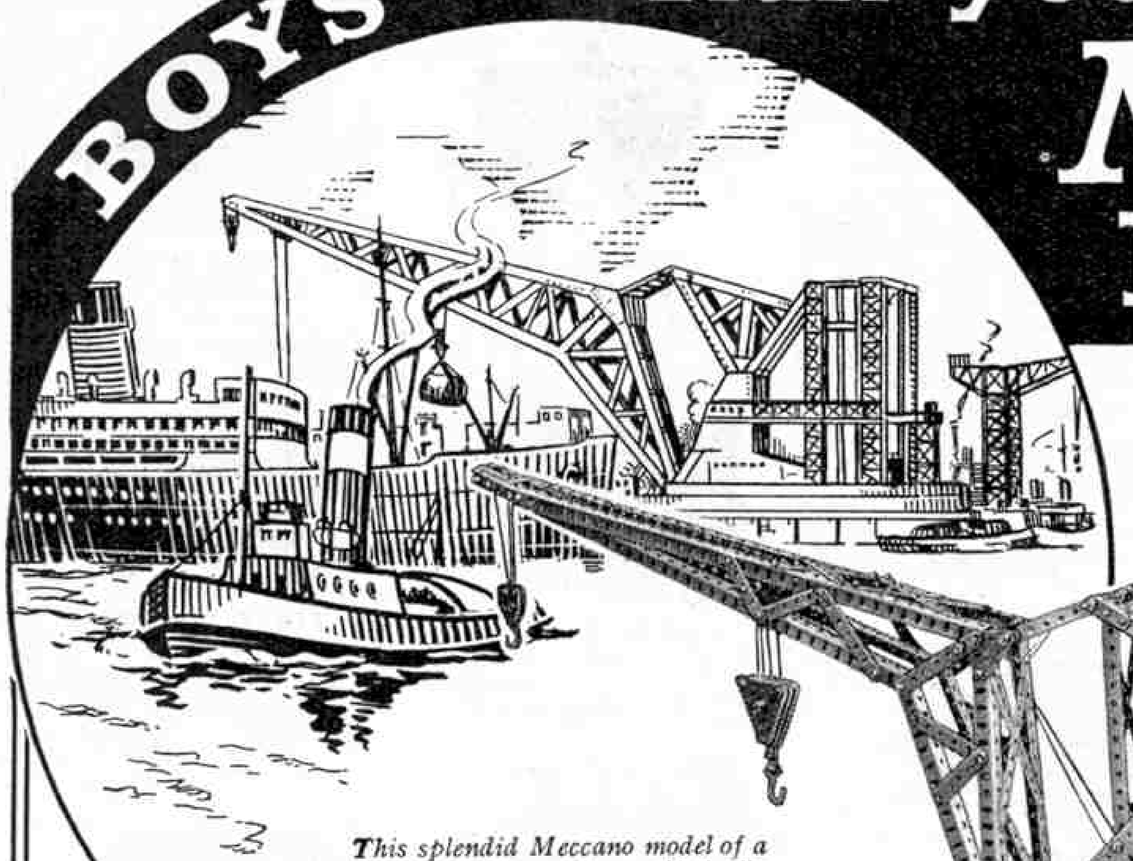
FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/11**



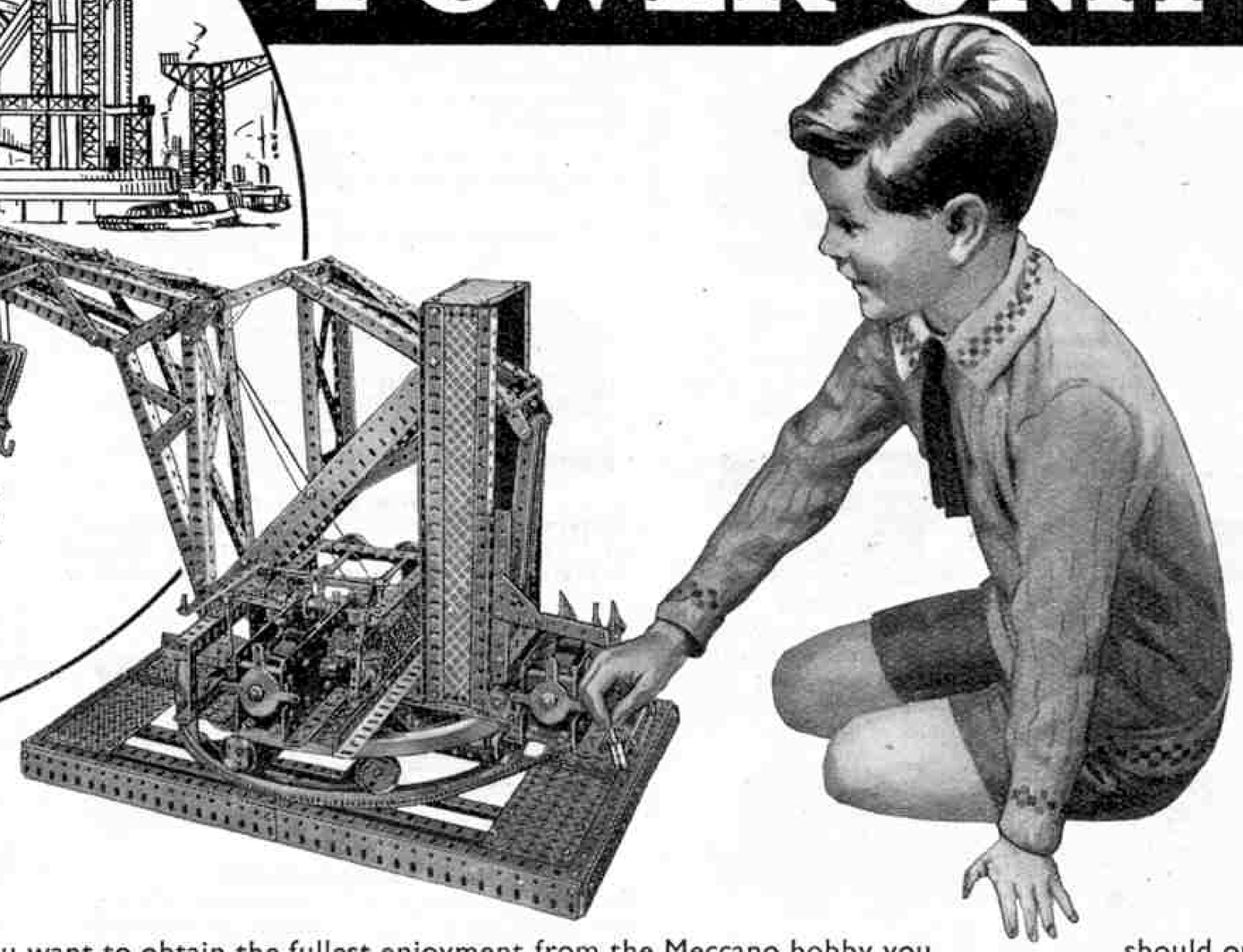
CEMENT WAGON
The door at the top opens. Finished in bright red. Price **2/6**

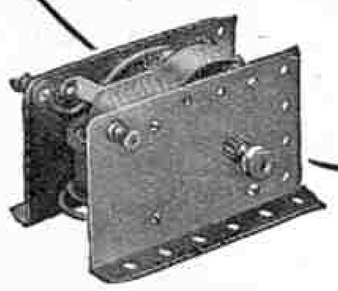
Manufactured by **MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13**

BOYS — Run your Models with a MECCANO POWER UNIT

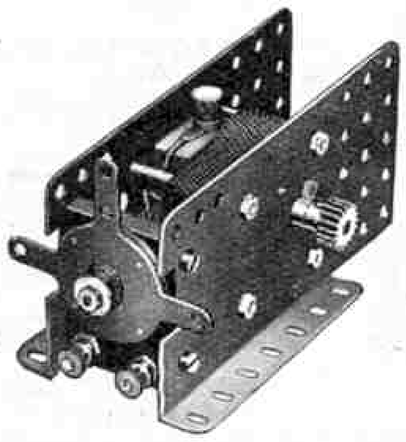


This splendid Meccano model of a Pontoon Crane is realistically operated by means of a Meccano Electric Motor

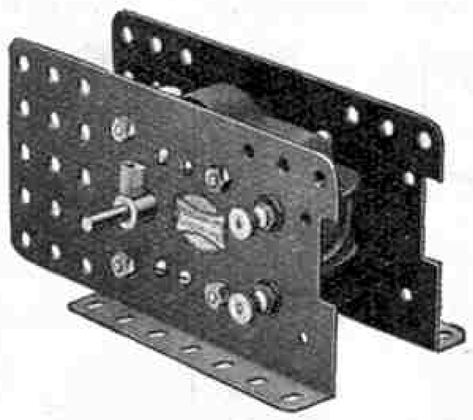




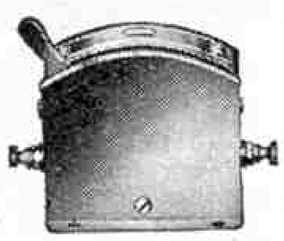
No. E1 Electric Motor (6-volt



No. E6 Electric Motor (6-volt



No. E20A Electric Motor (20-volt)



Resistance Controller

If you want to obtain the fullest enjoyment from the Meccano hobby you should operate your models by means of one of the Meccano power units listed below. Each one is strongly made and the utmost care is taken in its manufacture to ensure that it will give entire satisfaction.

CLOCKWORK MOTORS

X Series Clockwork Motor. This non-reversing Motor is specially designed to drive models built with Meccano X Series parts ... ... Price 2/6
No. 1 Clockwork Motor. Non-reversing ... ... ,, 5/–
No. 1A Clockwork Motor. Reversing ... ... ,, 7/6
No. 2 Clockwork Motor. Reversing ... ... ,, 10/–

ELECTRIC MOTORS

No. E1 Electric Motor (6-volt). Non-reversing ... Price 9/–
No. E6 Electric Motor (6-volt). Reversing ... ,, 15/6
No. E120 Electric Motor (20-volt). Non-reversing ,, 10/–
No. E20A Electric Motor (20-volt). Non-reversing ,, 16/6
No. E20B Electric Motor (20-volt). Reversing ... ,, 18/6

It is important to note that the 6-volt Electric Motors cannot be run satisfactorily from dry cells.

ACCUMULATORS

6-volt 20 amp. hr. Accumulator for running 6-volt Meccano Electric Motors ... ... Price 27/9
2-volt 20 amp. hr. Accumulator for converting a 4-volt accumulator to 6-volt ... ... ,, 9/3

RESISTANCE CONTROLLERS (6-volt or 20-volt)

By use of these Controllers the speed of Meccano Electric Motors and Hornby Electric Trains can be regulated as desired. Price (6-volt or 20-volt) 3/9

MECCANO STEAM ENGINE

Price 25/–

MECCANO TRANSFORMERS

A Meccano Transformer provides a means of driving a Meccano Electric Motor or Hornby Electric Locomotive from the mains where this is alternating current. There are six Transformers in the series, all of which are available for the following A.C. supplies: 100/110 volts, 50 cycles; 200/250 volts, 50 cycles; 225/250 volts, 50 cycles. Any of these Transformers can be specially wound for supplies other than the above. When ordering a Transformer the voltage and frequency of the supply must always be stated.

No. T6 Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors and Locomotives. Fitted with speed regulator. Price 17/6

No. T6M Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors and Locomotives. This is similar to No. T6, but is not fitted with a speed regulator ... ... Price 12/6

No. T6A Transformer (Output 40 VA at 9/3½ volts) for 6-volt Electric Motors and Locomotives. Fitted with speed regulator and separate circuit for supplying current for eighteen 3½-volt lamps ... ... Price 22/6

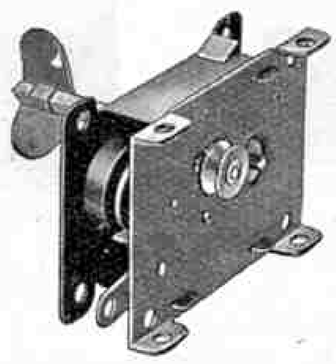
No. T20 Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors and Locomotives. Fitted with 5-stud speed regulator ... ... Price 17/6

No. T20M Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors and Locomotives. This is similar to No. T20, but is not fitted with speed regulator ... ... Price 12/6

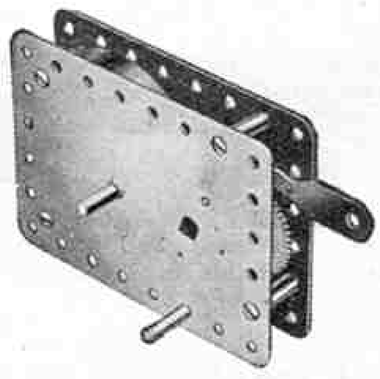
No. T20A Transformer (Output 35 VA at 20/3½ volts) for 20-volt Electric Motors and Locomotives. Fitted with speed regulator and output sockets for lighting lamps ... Price 22/6

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

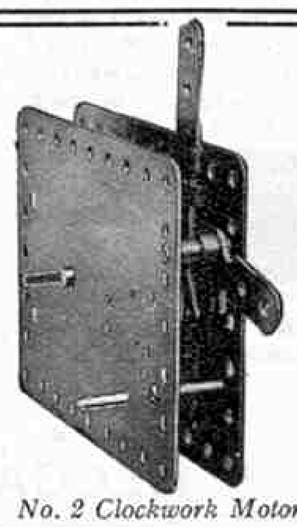
No. T20 Transformer



X-series Clockwork Motor



No. 1 Clockwork Motor



No. 2 Clockwork Motor

Accumulator (6-volt, 20 amp. hr.)

BOYS! Here is A REAL

Super "Adana" High Speed Automatic Self-Inking

PRINTING MACHINE!

WILL PRINT

1,000 COPIES PER HOUR

BOYS! Here is something you've often wished for—a Real Printing Machine! Not a toy or a model but an Automatic Self-Inking Adana Machine which uses real Printer's Metal Type and produces work just like that done by Professional Printers.

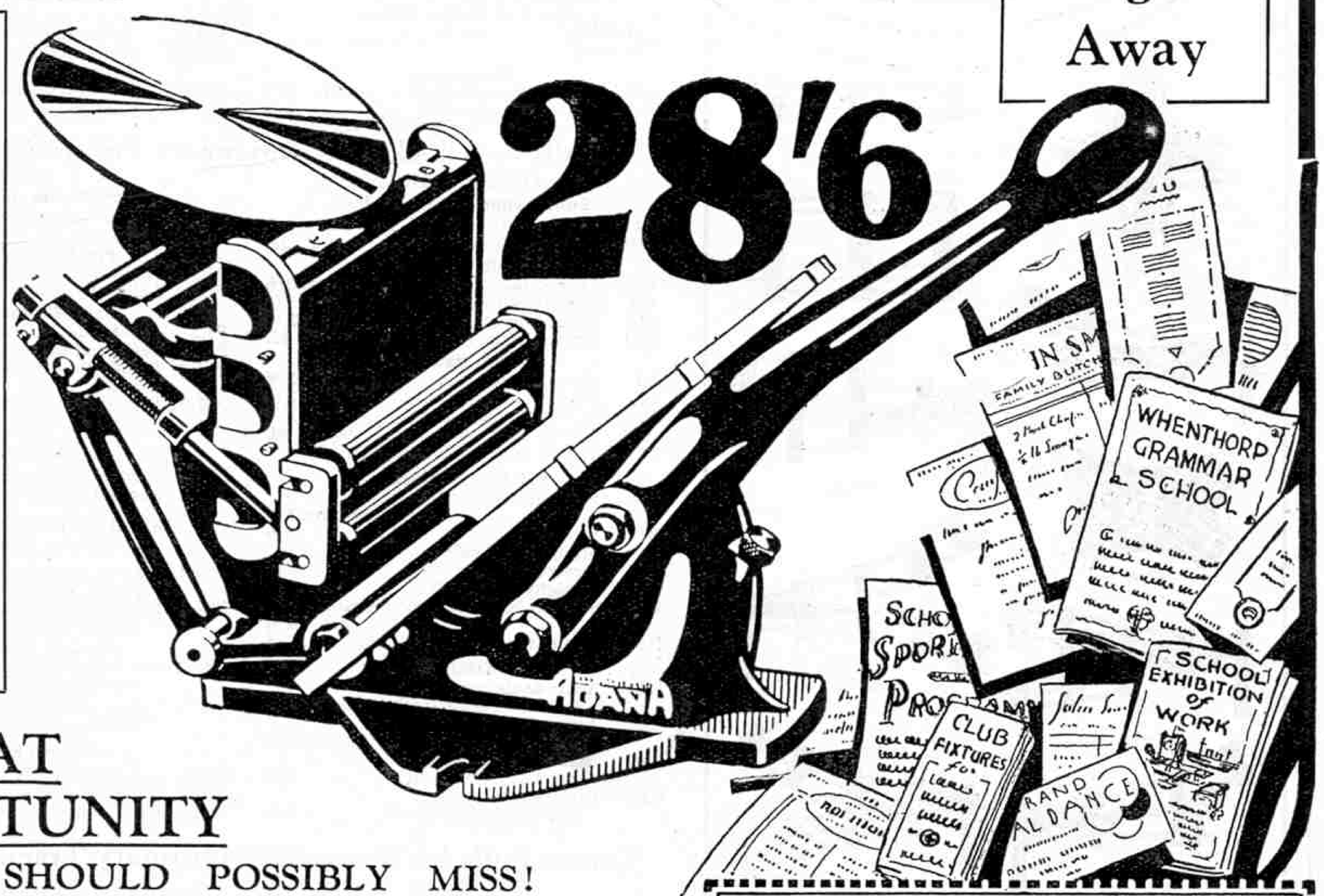
There's not a more exciting or interesting hobby than printing on my Wonderful Invention. You can print your own Note-headings and Visiting Cards—Entertainment Programmes—Party Invitation Cards and a 101 other interesting things. It's so fascinating that you'll want to spend every spare moment at it!

WHAT A THRILLING HOBBY

Get Dad to get you one Right Away

Here are some of the things my Machine will print

- Fixture Cards
- Concert Programmes
- Dance Invitation Cards
- Noteheadings
- Visiting Cards
- Menus
- Tradesmans' Bills
- Club Notices
- Etc., Etc.



A GREAT OPPORTUNITY

NO BOY SHOULD POSSIBLY MISS!

No more "make-shift" rubber stamps or duplicators—here's the real thing and so low in price that you **MUST NOT** miss the chance of getting it! Let me tell you all about my Wonderful Machine and what it will do. Send the coupon alongside TO-DAY and I will send you FREE actual samples of work produced and explain how I will let you have it on Special Terms. No boy should miss this Splendid Bargain. It is a Real Commercial Machine, for many men make a lot of Money by printing on it for Local Tradesmen, etc. Find out all about it NOW. Send the Coupon alongside at once to

Mr. D. A. ADANA (Dept. M.C.15), 17, Church St., Twickenham, Middlesex.

LONDON Showrooms: Ludgate House, Fleet Street, E.C.4.

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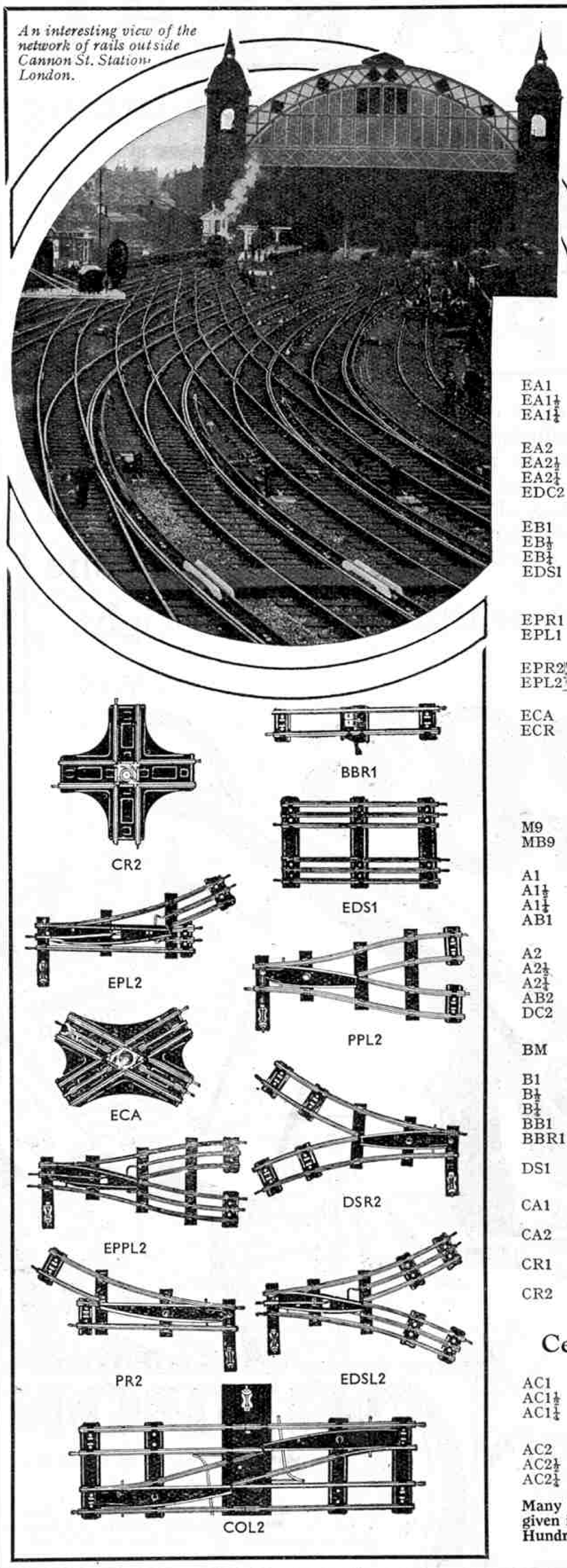
To Mr. D. A. Adana (Dept. M.C.15), 17, Church St., Twickenham, Middlesex.

Dear Sir,

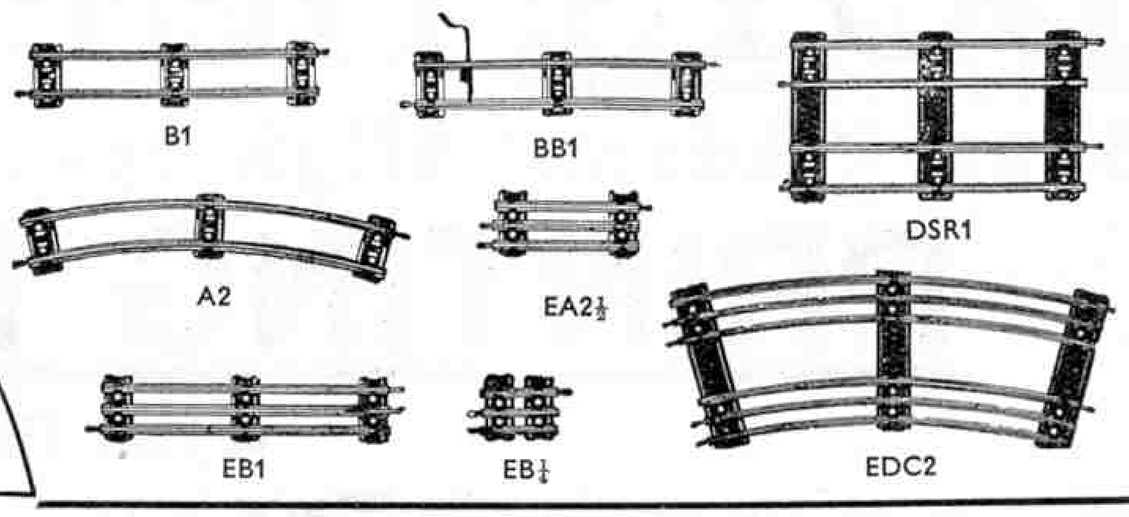
Please send me at once and FREE, full details of your Wonderful Adana Printing Machine—together with samples of ACTUAL Work produced, and Easy Payment Terms.

Cut out this Coupon and Post at once with your full name and address attached.

Hornby Rails, Points and Crossings



An interesting view of the network of rails outside Cannon St. Station, London.



Rails for Electric Trains, Gauge 0, 1¼″

CURVED RAILS

1-ft. Radius

EA1	Curved Rails ...	... per doz.	5/–
EA1½	Curved half rails ...	„	4/6
EA1¼	Curved quarter rails ...	„	4/–

2-ft. Radius

EA2	Curved rails ...	... per doz.	5/–
EA2½	Curved half rails ...	„	4/6
EA2¼	Curved quarter rails ...	„	4/–
EDC2	Curved rails, double track, ½ doz.		9/–

STRAIGHT RAILS

EB1	Straight rails ...	... per doz.	5/–
EB½	Straight half rails ...	„	4/6
EB¼	Straight quarter rails ...	„	4/–
EDS1	Straight rails, double track, ½ doz.		8/6

POINTS

For 1-ft. Radius Curves

EPR1	Right-hand points }	... per pair	5/9
EPL1	Left-hand points }		

For 2-ft. Radius Curves

EPR2	Right-hand points }	... per pair	6/6
EPL2	Left-hand points }		

CROSSINGS

ECA	Acute-angle crossings ...	each	2/9
ECR	Right-angle crossings ...	„	2/9

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

EDSR1	Double symmetrical points, right-hand }	... per pair	6/–
EDSL1	Double symmetrical points, left-hand }		

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand }	... per pair	7/–
EDSL2	Double symmetrical points, left-hand }		

PARALLEL POINTS

EPPR2	Parallel points, right-hand }	per pair	
EPPL2	Parallel points, left-hand }		7/–

CROSSOVER POINTS

ECOR2	Crossover points, right-hand }	per pair	
ECOL2	Crossover points, left-hand }		24/–

EMC20	Switch rail (20-volt) ...	each	1/3
EMC6	Switch rail (6-volt) ...	„	1/3
TCP20	Terminal Connecting Plates (20-volt)	„	1/3
TCP6	Terminal Connecting Plates (6-volt)	„	1/3

Rails for Clockwork and Steam Trains, Gauge 0, 1¼″

CURVED RAILS

9-in. Radius (for MO Trains)

M9	Curved rails ...	... per doz.	2/6
MB9	Curved brake rails ...	each	3d.

1-ft. Radius

A1	Curved rails ...	... per doz.	3/6
A1½	Curved half rails ...	„	3/–
A1¼	Curved quarter rails ...	„	2/6
AB1	Curved brake rails ...	each	4d.

2-ft. Radius

A2	Curved rails ...	... per doz.	3/6
A2½	Curved half-rails ...	„	3/–
A2¼	Curved quarter rails ...	„	2/6
AB2	Curved brake rails ...	each	5d.
DC2	Curved rails, double track, ½ doz.		6/–

STRAIGHT RAILS

BM	Straight rails (for MO Trains),	per doz.	2/6
B1	Straight rails	„	3/6
B½	Straight half rails ...	„	3/–
B¼	Straight quarter rails ...	„	2/6
BB1	Straight brake rails ...	each	4d.
BBR1	Straight brake and reverse rails,	each	1/6
DS1	Straight rails, double track, ½ doz.		5/3

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/9
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/9
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6

POINTS

9-in. Radius (for MO Trains)

MR9	Right-hand points }	... per pair	3/–
ML9	Left-hand points }		

For 1-ft. Radius Curves

PR1	Right-hand points }	... per pair	3/–
PL1	Left-hand points }		

For 2-ft. Radius Curves

PR2	Right-hand points }	... per pair	3/–
PL2	Left-hand points }		
PSR2	Points on solid base, right-hand ... ... }	per pair	8/6
PSL2	Points on solid base, left-hand ... ... }		

PARALLEL POINTS

PPR2	Parallel points, right-hand }	per pair	3/6
PPL2	Parallel points, left-hand }		

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double symmetrical points, right-hand }	... per pair	3/6
DSL1	Double symmetrical points, left-hand }		

For 2-ft. Radius Curves

DSR2	Double symmetrical points, right-hand }	... per pair	3/6
DSL2	Double symmetrical points, left-hand }		

CROSSOVER POINTS

COR2	Crossover points, right-hand }	per pair	
COL2	Crossover points, left-hand }		12/–
RCP	Rail Connecting Plates ...	½ doz.	2d.

Centre Rails for Converting Ordinary Track to Electrical

1-ft. Radius

AC1	Curved centre rails ...	per doz.	1/–
AC1½	Curved centre half rails	„	9d.
AC1¼	Curved centre quarter rails	„	6d.

2-ft. Radius

AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails	„	9d.
AC2¼	Curved centre quarter rails	„	6d.

BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	„	9d.
BC¼	Straight centre quarter rails	„	6d.

ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails	„	6d.

Many interesting illustrations and much useful information regarding Hornby Railway layouts are given in the booklets entitled "How to plan your Hornby Railway," and "Hornby Layouts—One Hundred Suggestions." Each of these booklets is obtainable from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d. post free.

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THE ALL-STEEL BICYCLE

The chap who **knows** about bikes always wants a Raleigh. He appreciates its finer points, its better performance, its swift and easy running. He knows a Raleigh's so strong it can stand up to the hardest work. That its special all-steel frame is so well constructed and carefully balanced that the bike is lightness itself. Also, it's got a For Ever Guarantee! Send for the "Book of the Raleigh" to-day, and talk it over with your people. Then **your** Dad will say "You've shown yourself an expert by choosing a Raleigh."

● *From* **£4.7.6** *Cash or* 12 *monthly payments of* **8/9.** *Fitted with Dunlop Tyres, Brooks' Saddle and the best of everything. Specify the Sturmey-Archer Three-Speed Gear,* 20/– *extra.* Send for free copy of "The Book of the Raleigh" and name and address of nearest dealer.

THE RALEIGH CYCLE CO. LTD., NOTTINGHAM
(Depots and Agents Everywhere)

Fit the Sturmey-Archer 3-speed gear—the gear that "makes cycling easy"

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8/- DOWN brings immediate delivery of a Riley "Home" Billiard Table. You pay balance as you play.

7 DAYS' Free Trial. Rileys pay carriage and take transit risks.

Hours of endless enjoyment may be spent on a Riley Billiard Table—enjoyment in which all the family can participate. Father, mother, boys and girls will be equally keen on this popular pastime. But it should be played on a REAL Billiard Table and not a toy. Play it on a Riley, every model of which is a perfect replica in construction of a full size Billiard Table. Sizes and prices of Riley "Home" Billiard Tables are shown below, also the easy monthly payments.

4 ft. 4 ins. × 2 ft. 4 ins.	...	£7	0	0	or in 20 monthly payments of 8/– 10/3 13/3 17/– 24/6
5 ft. 4 ins. × 2 ft. 10 ins.	...	£9	0	0	
6 ft. 4 ins. × 3 ft. 4 ins.	...	£11	15	0	
7 ft. 4 ins. × 3 ft. 10 ins.	...	£15	0	0	
8 ft. 4 ins. × 4 ft. 4 ins.	...	£21	10	0	

DINE AND PLAY ON THE SAME TABLE

The Riley "Combine" Billiard and Dining Table offers something unique in house furnishing, combining in one a beautiful dining table and a flawless billiard table. After dining, it is ready in a couple of minutes for a delightful game of billiards. Available in many attractive designs, oak or mahogany, for cash or on easy terms. Here are the sizes and prices for the round leg mahogany pattern.

WRITE TO-DAY FOR ART LIST.

5 ft. 4 ins. × 2 ft. 10 ins.	...	£22	10	0
6 ft. 4 ins. × 3 ft. 4 ins.	...	£26	10	0
7 ft. 4 ins. × 3 ft. 10 ins.	...	£33	0	0
8 ft. 4 ins. × 4 ft. 4 ins.	...	£43	0	0

or in 13 or 20 monthly payments.

Rileys are the largest makers of full size Billiard Tables in Great Britain. Also specialists in accessories, re-covering tables, etc.

This is the Riley "Cabriole" design 6 ft. size, £34 10 0, or in 13 or 20 monthly payments.

E. J. RILEY LTD.

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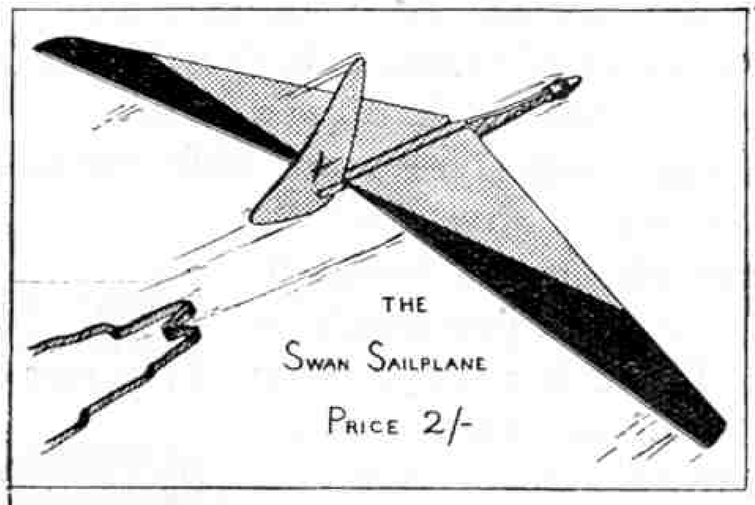
and Dept. 6, 147, Aldersgate Street, London, E.C.1



A MODEL GLIDER THAT

LOOPS! ROLLS! SPINS!

SKYBIRDS have recently introduced this tailless flying model Sailplane or Glider, "The SWAN SAILPLANE," which is something quite out of the ordinary and gives a really remarkable performance. It will loop, roll and spin! The price is only 2/-.

SHIPSERIES

CONSTRUCTIVE WATERLINE MODELS OF FAMOUS SHIPS

SHIPSERIES LEAGUE

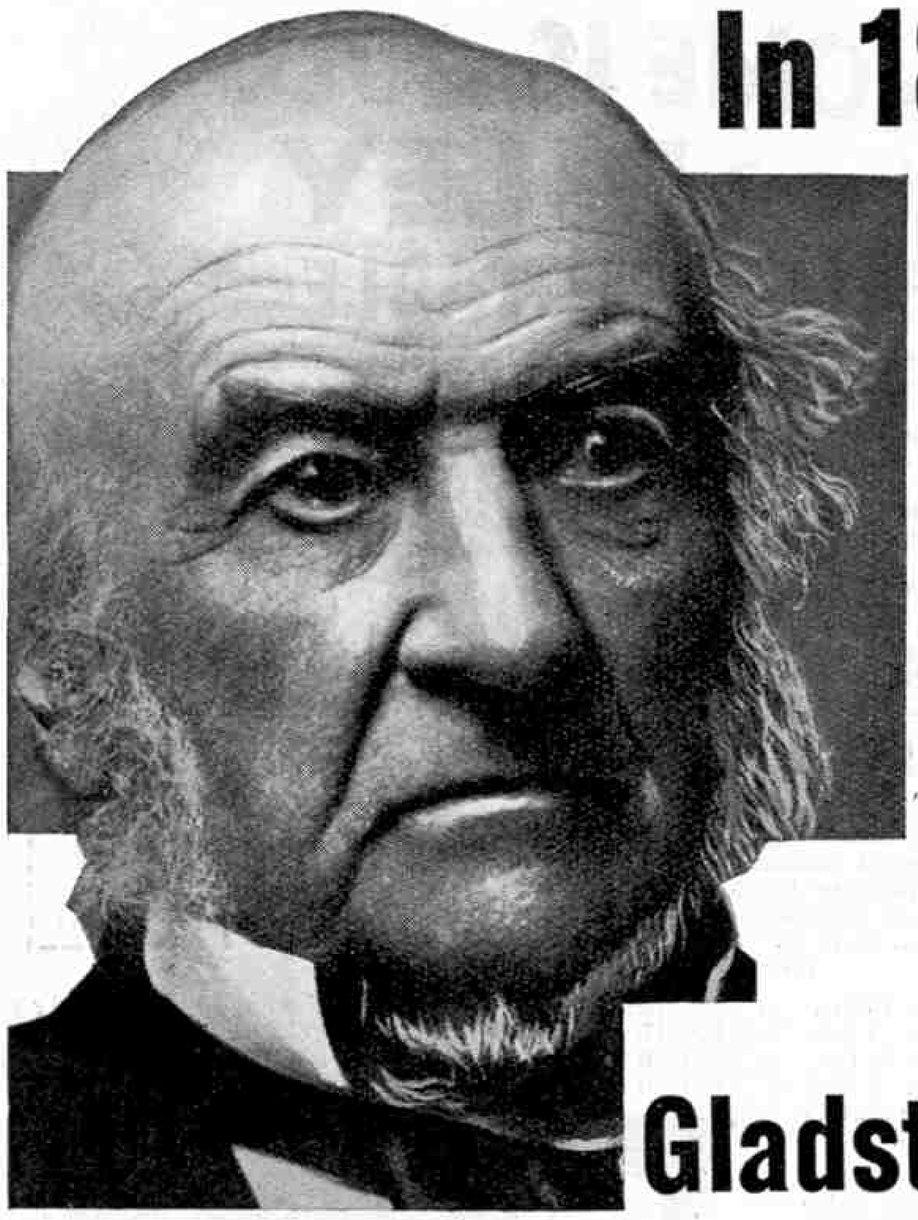
Scale 100 feet equals 1 inch

SHIPS of the ROYAL NAVY, MERCHANT NAVY & ACCESSORIES

The latest accessory - **DOCKS**

These are supplied in sections, Dock 6" x 2" with Shed and 3 cranes. Price 1/-.

For address of nearest Agent write:
A. J. HOLLADAY & CO. LTD.
3, ALDERMANBURY AVENUE, LONDON, E.C.2



In 1884

Gladstone,

the famous statesman, was

PRIME MINISTER of ENGLAND

Gladstone was Prime Minister of England in 1884—the year Seccotine was discovered. Both the statesman and the adhesive have achieved fame . . . in fact, Seccotine is more popular to-day than ever before.

The proved strongest adhesive—more than twice as strong as any other!

Use it on your models. Just a smear in the joint and when it is set you won't be able to break it! There is always a job for Seccotine in the house—broken vases, ornaments, furniture, etc. Ask for Seccotine and look for the name on the tube and carton.

FIRST & STILL THE FINEST

1884-1934 50th ANNIVERSARY

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There is no substitute for

SECCOTINE

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Post this for FREE BOOKLET

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Please send me a copy of your Free Booklet

Name.....

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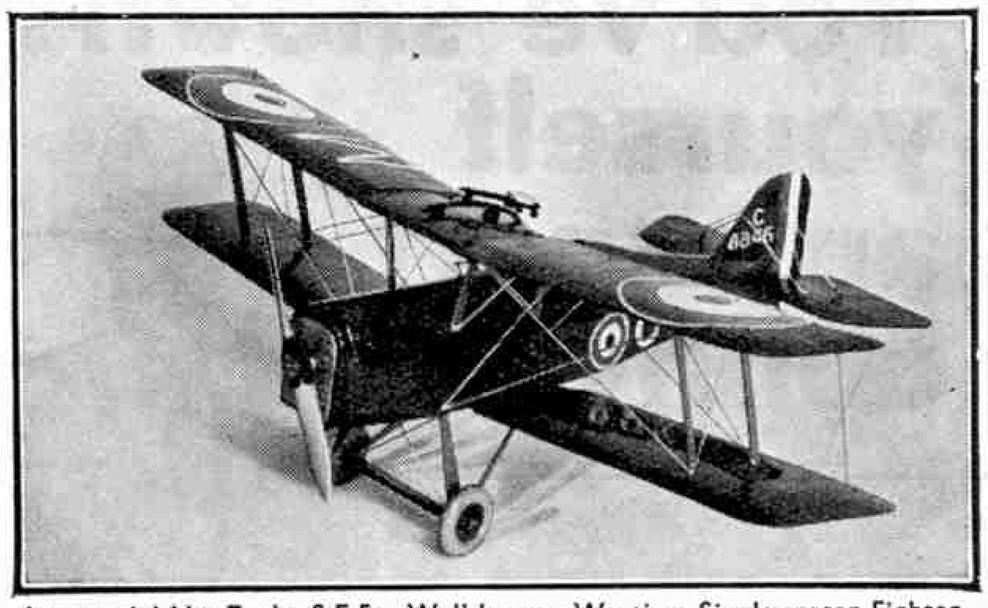
A NEW AEROMODEL



Aeromodel No. 7, the S.E.5a. Well-known Wartime Single-seater Fighter, flown by famous British Aces. Aeromodel Construction Sets are acclaimed by experienced model builders at home and abroad as "The Finest True to Scale Kits obtainable."

Other Models	PRICE	Post free Gt. Brit.	do. Abroad
1. GIPSY MOTH	3/–	3/4	4/–
2. COMPER "SWIFT"	3/6	3/10	4/6
3. PUSS MOTH	3/6	3/10	4/6
4. SCHNEIDER SEAPLANE ...	4/–	4/4	5/–
5. DE HAVILLAND "DRAGON"	7/6	8/–	8/9
6. DE HAVILLAND "FOXMOTH"	4/–	4/4	5/–
7. S.E.5a	3/6	3/10	4/6
8. HAWKER HART	5/–	5/6	6/–

Fill in the coupon and post it to-day. A ½d. stamp is sufficient if the envelope is unsealed.

Please send me free illustrated literature containing full details of all Aeromodel Sets.

Name .....

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BIG CASH PRIZES VALUABLE BOOKS

and National Savings Certificates

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TUROG ESSAY COMPETITION

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£320 in prizes to be won

Ask your Baker for the TUROG ESSAY COMPETITION FOLDER, giving full details—

or write to SPILLERS LIMITED, 40, ST. MARY AXE, LONDON, E.C.3 *when full particulars will be immediately forthcoming.*

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A Silverwhite Double Albert presented FREE with every watch.

Post free on three days' approval.

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Gent.'s Nickelled lever with patent unbreakable glass	2/9
Gent.'s superior 3-piece Nickelled lever, solid pinions, reliable time-keeper, suitable for hard wear	5/6
Gent.'s highly recommended extra special Chromium case lever, solid pinions, superior finish	7/6
THE FINEST WATCH ON THE MARKET which cannot be beaten for price or quality, highly recommended for those wanting a gent.'s first-class Chrome model lever with jewelled movement, thoroughly examined and guaranteed	15/6

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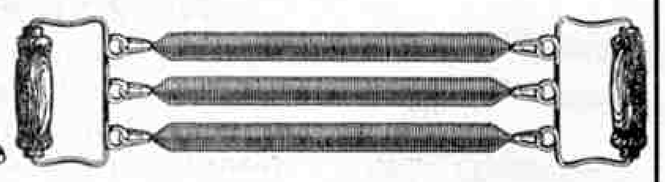

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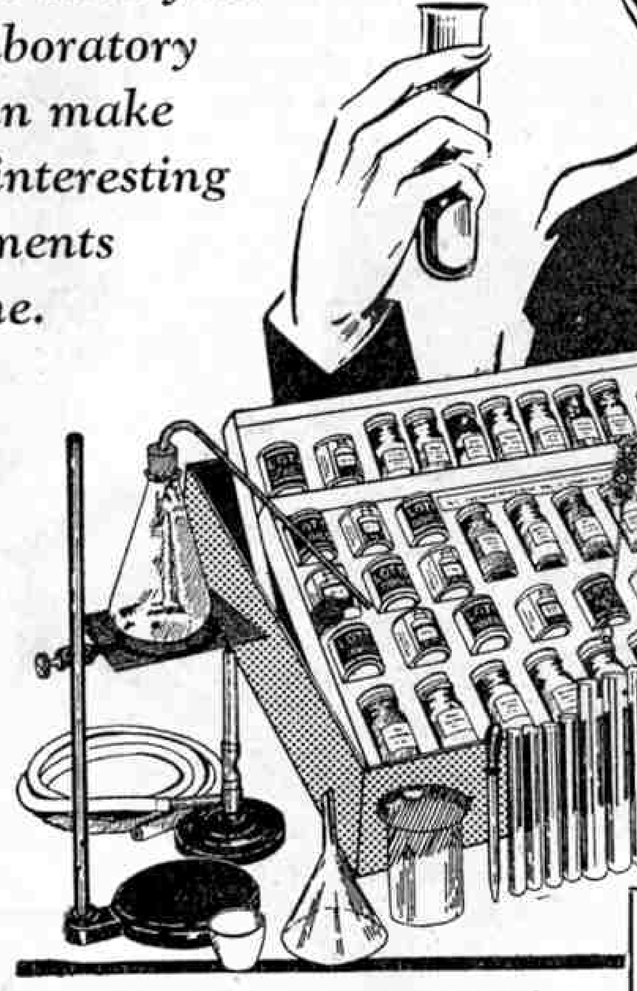

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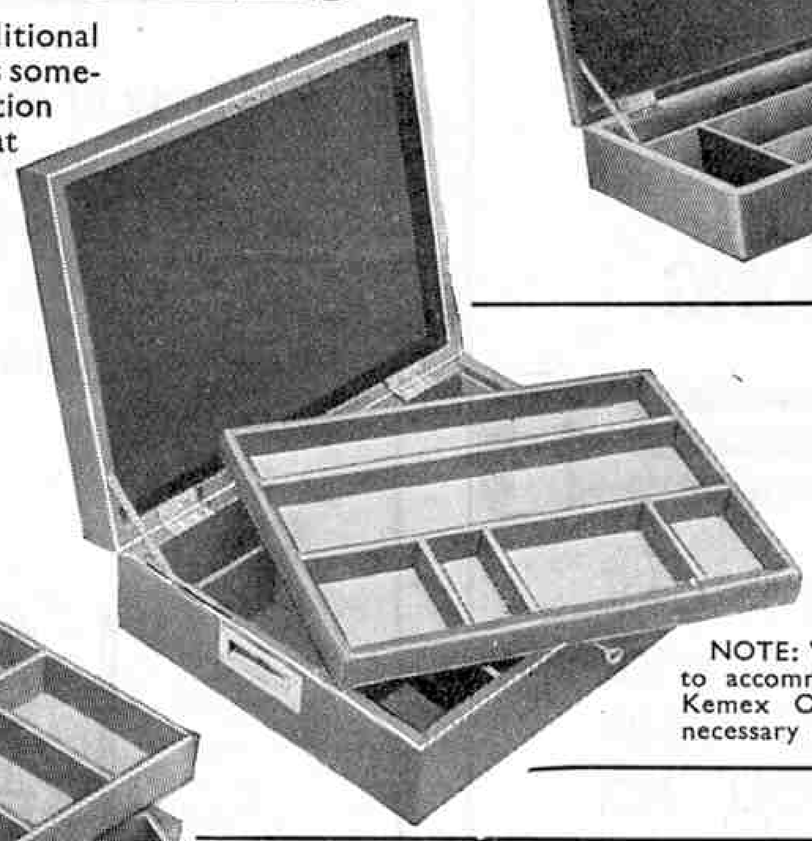

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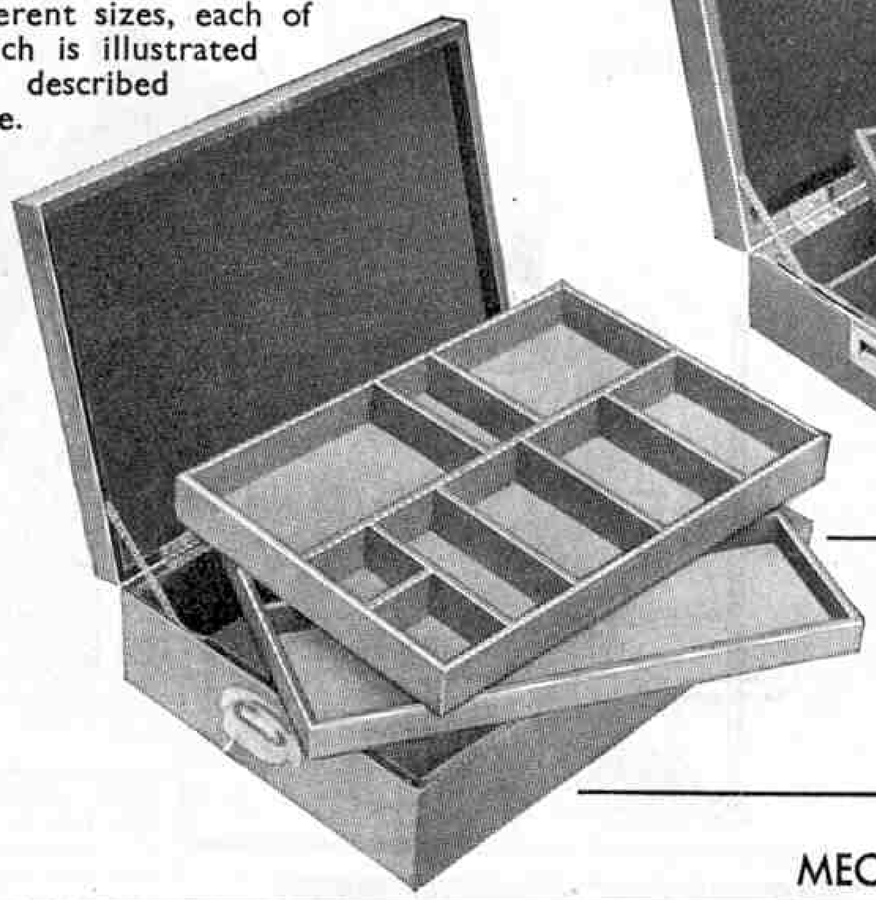

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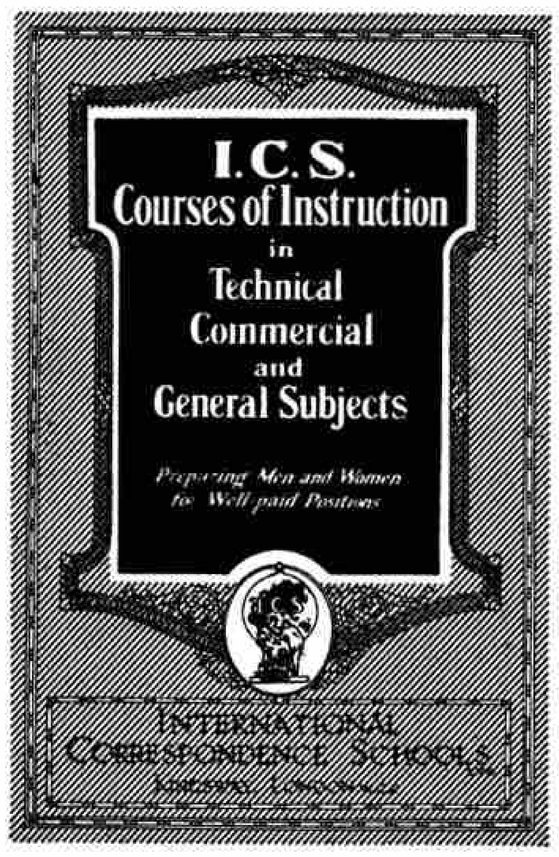

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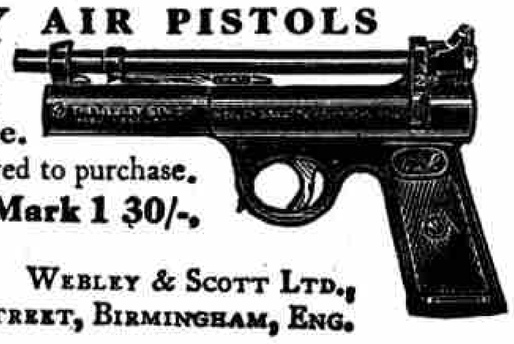

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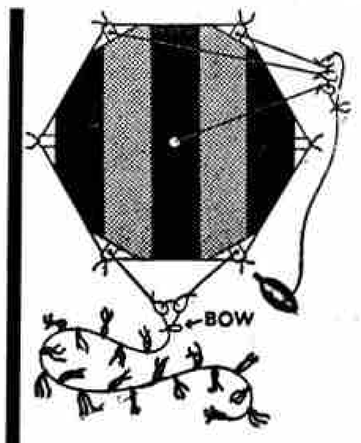

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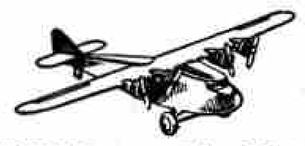

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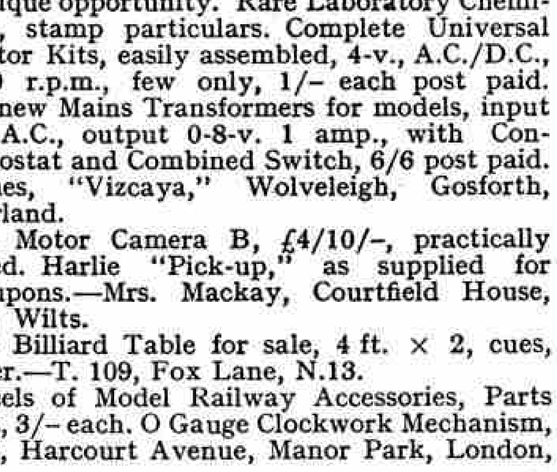

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Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

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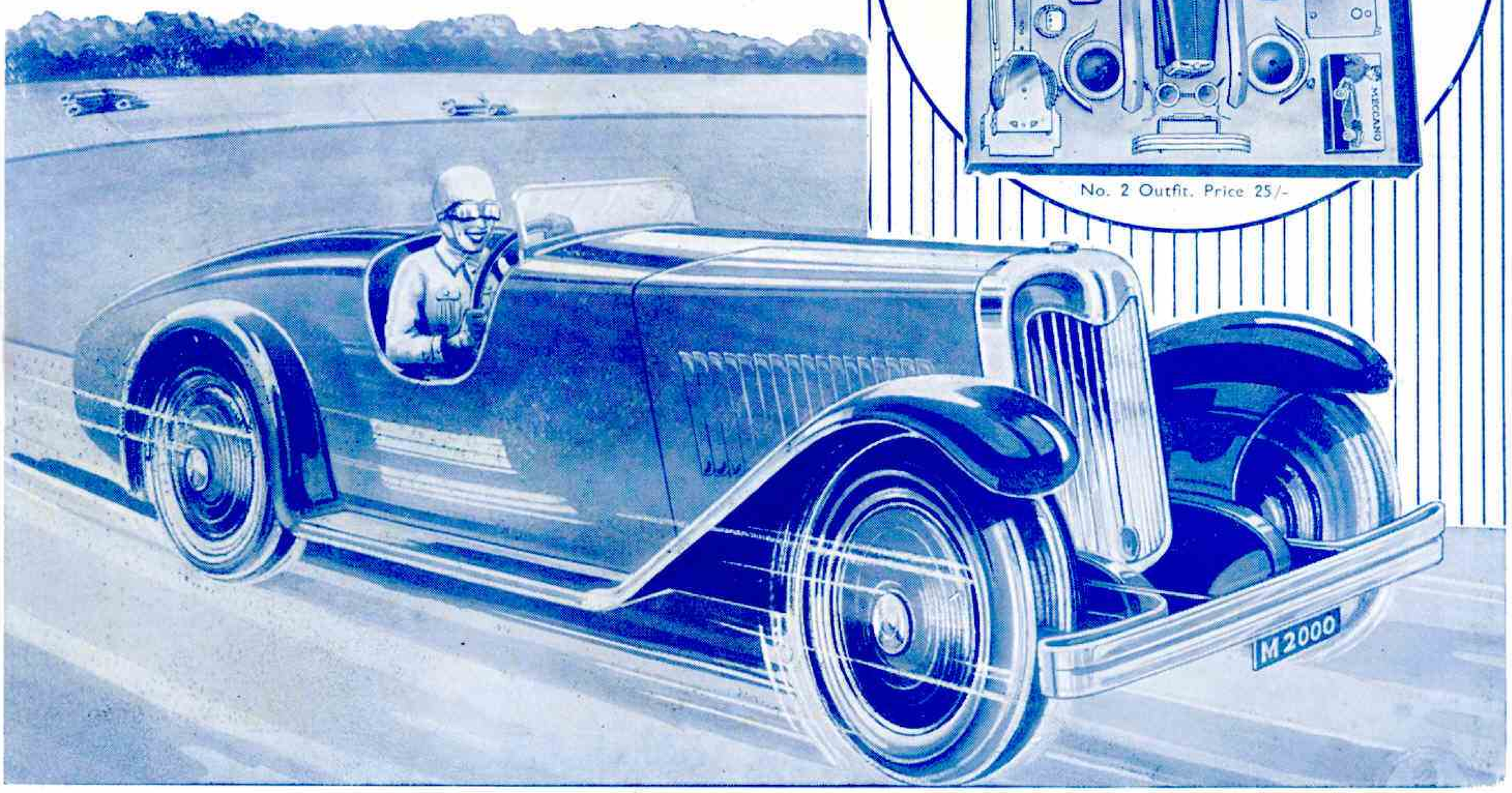

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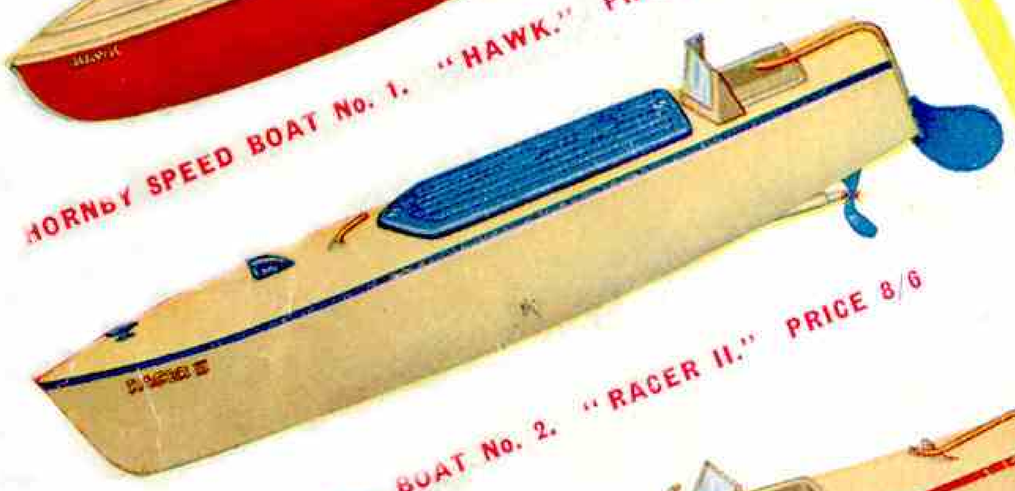

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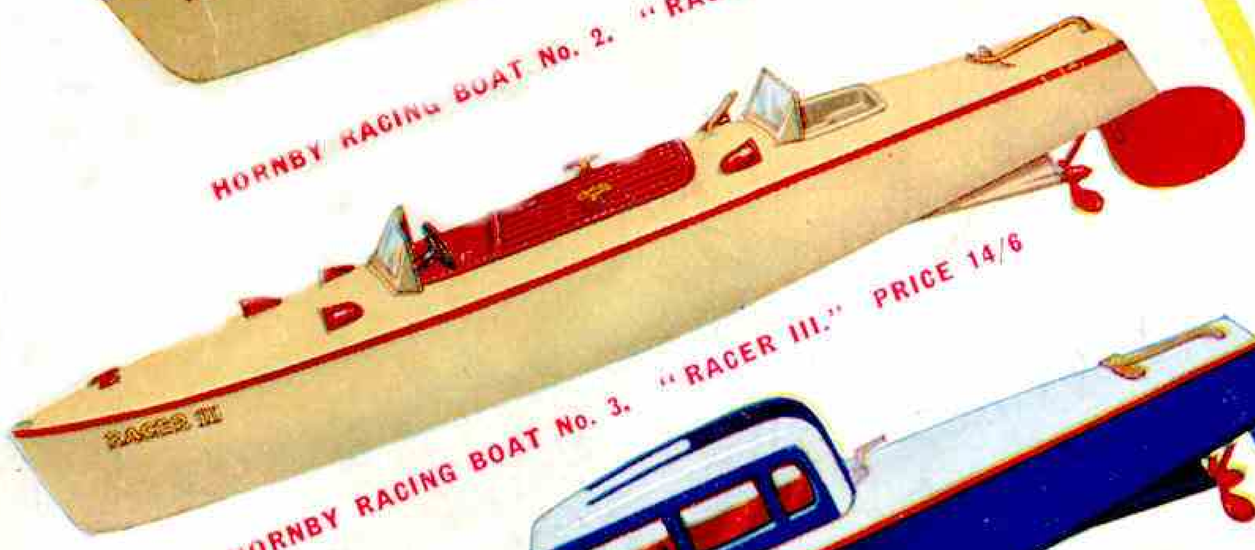

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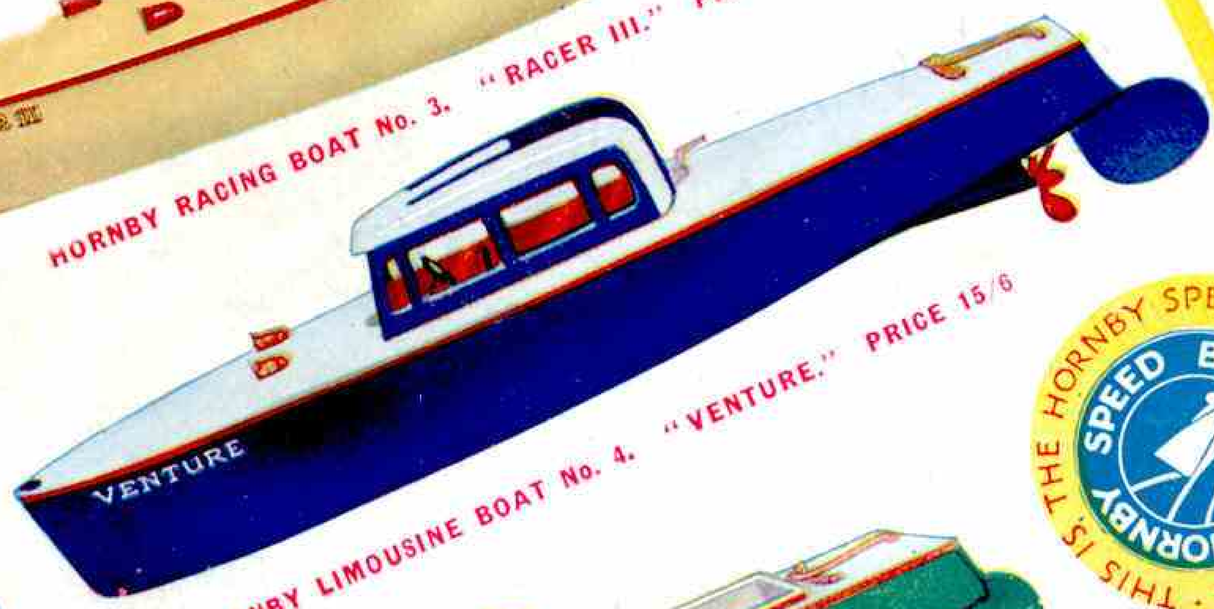

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PUBLISHED BY MECCANO LTD., BINNS ROAD, LIVERPOOL 13, ENGLAND.
Printed by John Waddington Ltd., Leeds and London.